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THE SYSTEM OF THE APPALACHIAN POWER COMPANY.

As our readers know, the Southern Appalachian country is rich in water-powers and the development of these has already had a notable influence in the industrial regeneration of the South. From the hydraulic standpoint the situation all through this region is somewhat peculiar. The rainfall in the mountains is rather heavy, but the streams traverse a long stretch of somewhat hilly country presenting only moderate slopes for a long time after leaving the mountains. The mountain sources themselves are usually rather small and numerous and the whole Appalachian territory is characterized by the almost complete absence of natural lakes, although here and there are admirable opportunities for storage. The developments along these streams are therefore on the whole rather low-head propositions with a good volume of water requiring the help of artificial storage if it is to be used at anything like its full value. Nevertheless, the sites are many and valuable. The common situation is very characteristically shown in the initial plants of the Appalachian Power Company described in this issue. The developments are on the New River in the southwestern corner of Virginia, less than 20 miles from the North Carolina line and not much further from the West Virginia line. Within a stretch of 25 or 30 miles lie five separate hydroelectric sites taking the full volume of the river and having an aggregate fall of about 225 ft., the total normal development rating being about 75,000 hp.

Of these sites, those known as Nos. 2 and 4 have been already developed to a total of about 29,000 hp, the chief market being found in the mining region of Virginia and West Virginia, including the famous Pocahontas coal fields. The enterprise, therefore, furnishes an excellent example of hydraulic power actually displacing steam power in a coal-mining industry. The electric-service systems of seven towns have been already acquired by the Appalachian Power Company and 88,000-volt transmission lines have already been built to other markets, including the Pocahontas coal field. The first plant to be completed was Plant No. 4, containing three 3000-hp units. This plant takes advantage of an island in the river, and by constructing a spillway dam about 1000 ft. long the water is turned into a natural headrace on the north side of the island terminated by the retaining dam of the power house. The clearing out of a deep tailrace for about 1800 ft. below this point gives an available head of about 38 ft. The plant is built in solid concrete, except for the power house proper, which is of brick and steel. The turbine units are a little unusual in character in that they are all vertical-shaft machines with single-runner Francis turbines working at 97 r.p.m. Each turbine has its own inlet passage molded in the concrete foundations of the plant. Two exciters, also on vertical shafts, are installed in addition. The generators are 60-

cycle, three-phase machines, wound for 13,200 volts, in accordance with a policy involving the whole handling of the development.

Plant No. 2 is much larger than Plant No. 4. The available head is about 50 ft. and the power-house bulkhead wall forms part of the main dam, which has a total length of about 750 ft. An auxiliary spillway made by cutting through a ridge into a natural gulley furnishes a safe outlet for high water. This plant, like No. 4, is equipped with single-runner vertical-shaft turbines, in this case of 5000-hp rating and operating at 116 r.p.m. The generators are similar to those in Plant No. 4, and two exciters are also installed here. The most striking peculiarity of the system is the fact that for both these stations, and for the proposed later additions as well, a single transformer house is provided. This is located near the site of the power house of Plant No. 2, about midway of the total length of the proposed developments, and the 13,200-volt generators enable the lines to be brought into a central transformer house without much loss of energy. All the transforming and regulating apparatus is therefore placed at one point, leaving the generating stations themselves exceptionally easy to operate.

According to present arrangements the transformer house contains four 6000-kw water-cooled three-phase units, raising the emf from 13,200 volts to 88,000 volts. The transmission circuits already erected aggregate nearly 200 miles in various directions. They are of very simple construction, using 45-ft. wooden poles with the "wishbone" type of cross-arm construction, formed in this case of two 6-in. by 4-in. oak timbers. A steel bayonet grounded at each pole carries a ground cable 2 ft. above the pole top. The insulators are of the four-disk suspension type. All secondary transmission circuits are operated at 13,200 volts. Contracts for the supply of energy have been made with a considerable number of mining companies and several railway and lighting systems. As is not unusual in recent transmission systems, some existing steam plants have, under contract with their owners, been utilized as relay stations for auxiliary service. One of these is the 7500-kw steam-turbine plant belonging to the Pocahontas interests, so that without building reserve plants a large amount of reserve steam power is practically at the disposal of the service company. Altogether the system is an important addition to the resources of the South and an excellent example of modern transmission practice.

ENERGY TRANSMISSION AT CONSTANT CURRENT.

Considering the fact that twenty years ago, in its beginnings, the three-phase transmission system was looked upon with grave suspicion by engineers chiefly familiar with direct-current systems, it is rather remarkable that America presents no examples of direct-current transmission, while the Thury system cannot be left out of the reckoning in European practice. Since about 1890 fifteen of these constant-current Thury plants have been installed and continued in regular and successful operation. The most notable of them is the Moutiers-Lyons plant, 112 miles straight-away, with a maximum working emf of 57,600 volts, a value which it is proposed later to double.

The chief objection to the system from a constructural standpoint is the relatively small size in which the units must be built, owing to the difficulties of commutation. Designers have learned from experience and are now able to produce direct-current machines for constant current for voltages rising to 4000 or 5000, an output of probably 1000 kw or even 2000 kw. By driving two machines by a single prime mover, units of, say, from 2000 kw to 4000 kw therefore become available, giving 8000 volts or 10,000 volts at full load. The constructural features of a Thury station are therefore no longer forbidding. With five or six units one could reach 50,000 volts transmission emf, at 15,000 kw or 20,000 kw output, a size adequate for the vast majority of transmission enterprises.

The constructural inconvenience, on account of the necessity of insulating the generators from earth and from the prime mover, seems to have found a successful solution, as might be expected from our present knowledge of insulating materials. From the standpoint of general energy distribution the system is a peculiar one. It is unquestionably capable of beautiful results in delivering power in a single block. It also presents no difficulties in the way of taking off moderate amounts of power along the line, there being no troublesome transformer at extreme voltage to install. Yet, on the whole, it is much less convenient in general distribution than is a constant-potential system. To make up for the relatively small output and considerable cost of the individual generators the cost of switchboard appliances, no inconsiderable item in a modern three-phase station, becomes almost negligible. The generators are disconnected by short-circuiting them and connected in by opening the short-circuiting switch. The whole complex and bulky switching system ordinarily in use, therefore, disappears, and it is at least a question whether the abolition of this serious cause of trouble and expense does not fully make up for the extra cost of the generators themselves.

When it comes to line construction the series direct-current system has some important points in its favor. Inductive troubles on the line all disappear. There are only two wires instead of three to insulate, and a given insulator will withstand a much higher pressure if it is direct than if it is alternating. Some time ago Thury carried out a series of experiments on high alternating and unidirectional voltages, with the result of showing that on the average the direct voltage necessary to flash over a given distance is double the alternating voltage required for the same distance. In other words, if a given system of insulators is adapted for an alternating emf of, say, 50,000 volts, it would carry a much higher unidirectional voltage, Thury's experiments indicating practically 100,000 volts.

Of two transmission systems operating over the same distance with the same amount of power, the same energy loss in the conductors and the same insulation, it appears from the article by Mr. Alfred Still in this issue that the direct-current system has, owing to its much greater available voltage for the same factors of safety, a considerable advantage in cost of line over the three-phase system. This advantage differs under various assumptions, the probable power-factor, shape of the alternating wave, etc., but the figures derived for the cost of the three-phase line are from

two and one-half to six times that necessary for the direct-current line. In addition, it is entirely feasible in case of emergency to ground a high-tension direct-current conductor and work such part of the circuit as is available on the earth return. It is also unquestionably easier to work underground with direct current than with alternating-current cables at the high voltages demanded in transmission circuits, and Thury's proposition a few years since for a great transmission system from the upper Rhone to Paris was based on underground circuits. These facts do not prove, of course, that the series direct-current system will come into large use in transmission work, but the system has undeniably proved satisfactory in a number of important instances, and it possesses many features of interest to the engineer and constructor, especially when the problem before him is merely the transmission of a large block of power over a considerable distance. The series system is neither moribund nor unsuccessful. Any engineer who wanders through one of the large Thury stations and then calls to mind the usual long concrete catacombs bristling with high-tension insulators and filled with dozens of oil switches, scores of disconnecting switches, webbed with hundreds of feet of high-tension leads and spattered with automatic cut-outs, will stop and think a bit before he complacently sniffs at high-tension direct-current transmission.

THE SUPREME COURT DECISION.

Elsewhere will be found an abstract of the Supreme Court decision handed down last week in the "bathtub" case, to which we made some editorial reference in our previous issue. A comparison of the present unanimous decision with the majority and dissenting opinions of the same court in the famous Dick case, handed down last March, indicates that the strong arm of public opinion has been actively at work. In the Dick case, it will be recalled, the majority held that it was lawful for a patentee to stipulate or impose restrictions upon the *use* of his patented invention, even to the extent of restricting the kind of unpatented materials or supplies used therewith, as in a mimeograph machine. This was upheld on the ground that the patent grant to an inventor conveys to him no title to his invention which he did not possess before, but expressly gives him the right to exclude all other persons from the right to make, use or vend his invention or discovery for the term of the grant. Since the right to exclude others from using his invention is absolute and complete, it is subject to no limitations, and any form of restricted use is thus justified. The unlimited extension and application of this principle embodies obvious dangers, as Chief Justice White pointed out in his dissenting opinion. His view of the case was strongly supported by public sentiment, and Congress was stirred to action. Subsequent events are well known, but the great diversity of individual opinions as to the proper remedies, brought out in the hearings before the House committee on patents, combined with the effects of a powerful and aggressive lobby directed against any reform in the law whatever, sufficed to postpone decisive action at the last session of Congress.

The opponents of any change in the fundamental patent law now point to the decision in the "bathtub" case to prove that no unlawful restraint or monopoly of trade in violation of the Sherman act can find shelter under the patent statutes. Superficially this would seem to be true, for the court said specifically: "There is nothing in Henry versus Dick which contravenes the views herein expressed." But furthermore the court said in reference to the licenses on Arrott's patented device for applying enamel to ironware: "The agreements clearly, therefore, transcended what was necessary to protect the use of the patent or the monopoly which the law conferred upon it. They passed to the purpose and accomplished a restraint of trade condemned by the Sherman law." That is to say, the agreements in relation to the sale of such enameled ware and the control of the trade therein were held to be, first, unrelated to the use of the patent in any way and, second, in violation of the anti-trust law. Now the question arises, how would the case have been affected if the enamel-ware products themselves had been patented, in addition to one of the devices or processes employed in their manufacture? This appears to be the serious question at issue, and the decision fails to answer it, for if the license restrictions on a patented article itself are upheld by the Dick decision, and trade in the article is undisputedly monopolized and restrained by means of such licenses, the patent laws and the Sherman act still appear to be in contravention of one another. It will require not one but many decisions of the Supreme Court to clear the situation, if, indeed, it can be cleared at all in such manner, whereas amendment of the law after a thorough investigation by commission, as we have frequently pointed out, will settle the issues quickly and definitely.

STROBOSCOPIC EFFECTS OBTAINABLE WITH INCANDESCENT FILAMENTS AS ILLUMINANTS.

It is well known that the electric-lighting frequency of 60 cycles per second dominant in the United States was adopted with principal reference to the flicker-perceiving properties of the normal human eye. Researches in the laboratory have shown that at or near the luminous frequency of 66 cycles of flicker per second the stationary eye directed upon a stationary target is unable to perceive flicker, no matter how violent or intense the illumination or the flickering may be. As the illumination is reduced, or the range of flicker, or both, the limiting frequency at which stationary flicker can be perceived is reduced, until at two or three flicker cycles per second the eye is apparently most sensitive to feeble flickering illuminations, or to feeble ranges of flicker superposed on steady illuminations. In the case of the incandescent lamp, which necessarily emits two cycles of flicker for each cycle of alternating-current supply, the stationary eye looking straight at the filament could not perceive flickering on a circuit of 33 electric cycles per second, even though the filament became black at each current zero. With as few as 25 electric cycles per second or 50 flicker cycles per second, the stationary eye looking at an incandescing filament would certainly perceive flicker if the filament became black at the current zeros. With the ordinary range of flicker, however, occurring in actual filaments, it is rarely that the stationary eye can perceive flicker in lamps or in illumination on circuits of 25 current cycles per second.

With moving flicker—that is, with a stationary eye and moving target, or with a moving eyeball and stationary target, or with both eyeball and target in motion—the sensation of flickering can be produced at relatively enormous flicker frequencies, so that when flickering is perceived with incandescent lighting on 25-cycle-per-second currents it is ordinarily to be attributed to movements of the eyeball—that is, to occasional moving flicker effects. In the case of the alternating-current arc lamp, however, where the electrodes are alternately anode and cathode and where the anode and cathode are not equally hot, there will be a flicker frequency from the electrodes of the same frequency as the current, together with a flicker frequency from the arc flame of twice the current frequency. Consequently, an alternating-current arc lamp on 33 electric cycles per second flickers most objectionably, unless the electrodes are concealed from view, so that all the light shall come from the arc flame. Not until 66 electric cycles per second is reached does the direct visual image of a naked arc lamp cease to flicker, when the electrodes are in full view. At 60 electric cycles per second stationary flicker usually disappears, unless the observer imprudently gazes right at the electrodes. Even at 50 electric cycles per second, stationary flicker is seldom seen on arc-lighted walls or targets, unless the illumination is very intense.

Mr. C. F. Lorenz contributes an interesting article in this number on the stationary flicker due to incandescent lamps from the opposite viewpoint—that is, under conditions productive of the maximum flicker stimulus, as distinguished from the conditions under which the flickering shall be unnoticeable. Stroboscopic pictures are peculiar, in that they commonly combine both stationary and moving flicker, but there is considerable advantage to the observer of rapidly varying or transient phenomena if the flickering light they cause can be controlled and utilized for recording purposes. It is noteworthy that when it is desired to increase the flicker range of an incandescing filament a certain amount of gas is introduced with advantage into the lamp chamber, so as to increase the rate of heat dissipation.

COMMISSIONS TO FIX WAGES?

Not only the railways but all employers in industries "affected with a public use" are vitally interested in the major propositions of the award of the board of arbitration in the matter of compensation for locomotive engineers, made public this week. One of these propositions is in substance that if public utilities are placed under regulation as to their rates of charges for service they are entitled to regulative protection in the matter of the wages they shall be obliged to pay. Or, in the language of the award, "if the increase in wages places the public utilities in a position that does not enable them to secure a fair return upon capital invested and maintain a proper reserve, they should be allowed to increase their rates until they are in that position." While avoiding a direct ruling on the question as to whether or not the carriers are able upon the present basis of earnings to pay higher wages, the award rather significantly states that "if they are not able to pay such [increased] compensation with existing rates, there is just cause for them to open again the question of an increase of rates with the Interstate Commerce Commission."

To carry out the suggestion made by the board it is pointed out that it would be necessary to create national and state wage commissions which would have powers regarding labor employed by public utilities comparable with those now exercised with regard to capital by existing public service commissions. In another part of the award it is stated that there seems to be no way to obtain justice for the employer, the employed and the public "except to have a permanent board which shall have the problem of adjustment and maintenance of justice for the three parties continually before them."

We have already gone so far in committing our fates to commissions that the shock such propositions as these would have given us a few years ago is greatly minimized. The employer's right of freedom of contract has been limited in many important particulars. Now it is the employee's turn to be regulated. But the labor member of the arbitration board has been quick to observe this and to dissent from a proposal for industrial peace "which would shackle the rights of a large group of our citizens." In other words, regulation is all very well for the capitalistic goose, but will not do at all for the labor gander. This objection was to be expected. There is another, which the board does not meet by its statement that, in addition to the reliance placed upon the restraining power of public opinion, it may be necessary to qualify the principle of free contract in the service of public utilities. The proposed commissions might fix the wages that a given group of workers should accept if they worked at all, but how could the workers be compelled to abide by wage awards to the same extent that corporations are obliged to conform to rate rulings and commission orders? This question must be answered before the arbitration board's recommendations can be accepted as a way out of the difficulties of wage adjustments.

No way has yet been found to control unincorporated labor unions or to make court decrees effective against them. And, fully aware of this fact, refusal to incorporate is almost a principle of organized labor in the United States. In the Australian Commonwealth it was supposed that a panacea for labor troubles had been discovered when the compulsory arbitration laws were passed in several of the states. We were so told in this country, but later information is to the effect that repeated strikes have followed awards unsatisfactory to workers in various industries and the courts have been unable to make arbitration awards effective for the simple reason that there are not enough jails in the country to hold the men that it would have been necessary to sentence for contempt or for failure to comply with the terms of an award if it was to be made operative. Evidently it is an extremely jug-handled arrangement that in its nature can be enforced against one party but not against his antagonist.

Our employers, however, may view with considerable satisfaction the announcement from so responsible a body that there should be some consideration of where the cor-

poration is to get the money to pay the higher wages constantly demanded. The board's program is entirely consistent. Commission regulation is founded upon the proposition that public interests are higher than those of groups of individuals. The principle applies as well to wages as to charges. Having assumed to regulate the latter, the public, claiming protection from the disasters of labor disputes, is now told that it must assume the burden of fixing wages on a just scale—and also its share of such increased charges as may be a result of increased wages.

MERCURY-VAPOR RECTIFIER FOR LARGE OUTPUT.

The properties of gases are wonderful and manifold. Mercury vapor is no exception to the rule. It is now about ten years since the rectifying properties of mercury vapor were first utilized. It is a very wonderful fact that when a glass chamber containing electrodes and some liquid mercury is evacuated to a suitably high degree of vacuum electricity will pass through the chamber to the mercury as cathode, with only a few volts drop of potential; whereas, in the opposite direction, or from the mercury as anode, electricity can only pass with a drop of potential of hundreds, or even thousands, of volts. This is the basic principle of the mercury-vapor rectifier, by means of which storage batteries are now very generally charged from alternating-current mains, with little supervision, and without any rotating mechanism, unless, indeed, we regard gaseous atoms of mercury as mechanism on an ultramicroscopic scale.

The ordinary mercury-vapor rectifier, with its glass vacuum tube, has a limited current output, owing to the relatively low temperature range within which the apparatus can operate safely. It has been evident for some time that if the current-carrying capacity of the device is to be increased, the glass walls of the chamber must be replaced by metal, and valuable work along this line has been done by Dr. Peter Cooper Hewitt in this country. As this week's *Digest* mentions, an article has lately appeared in the *Elektrotechnische Zeitschrift,* by Mr. Bela B. Schaefer, describing some recent mercury-vapor rectifiers of 100-kw rating and higher. These devices are stated to weigh about 11 lb. per kilowatt of output, or belong to the same order of weight as ordinary transformers. They are constructed of steel and apparently require to be excited electromagnetically in order to make the mercury-vapor arc rotate uniformly within the chamber so as to distribute the heating regularly. Similar large metallic-case mercury rectifiers have been on trial in the United States for a considerable period, a description of the experimental Cooper Hewitt rectifier of this type having been given in our issue dated March 23, 1912.

It would seem, therefore, well within the scope of possibilities that the synchronous converter and its rotating congeners may disappear from service in the not remote future and be replaced by noiseless mercury-vapor rectifiers of large output. It would be curious if a type of machinery so generally used and so well established as the synchronous converter were relegated to the historical machinery museum. No doubt, the mercury-vapor rectifier, if made practicable in large sizes, would be better than the converter in substations in the matter of size, weight and first cost. That it would be so likewise in the matter of efficiency is not so obvious. At high voltages the efficiency of the vapor rectifier tends to be very high, since it charges only a few volts, by way of commission. But at 230 volts or less the same actual drop in voltage does not lead to a very high efficiency, whereas the synchronous converter is one of the most highly efficient machines we possess, especially when operated six-phase.

THE TRADE OUTLOOK.

In our department of industrial and financial news this week will be found the first instalment of a comprehensive review of electrical trade conditions, compiled from a general canvass of the field. The almost invariable note of optimism sounded by manufacturers in all branches of the industry is very striking. Substantial increases in the volume of business are the general rule and the future outlook seems to be regarded on the whole as excellent. Perhaps the most notable gain reported is in the output of electric vehicles. This is attributable in large measure to the aggressive educational campaign, which has stimulated public appreciation of the economic merits of electric vehicles. The decadence of the reciprocating steam engine for central-station service on a large scale has been going on for some years, and is simply one of those changes due to advances in the steam-motor art to which the industry as a whole must adjust itself. Engine manufacturers in many cases have, as a natural consequence, contemplated or actually entered the turbine field. It is also interesting to notice that engineering advice or assistance from the manufacturer to the customer is becoming more and more a factor in successful salesmanship. The day of the engineering salesman in many lines has definitely arrived.

The complaint of one of the motor manufacturers that the monopolistic tendencies of some of the larger companies are the greatest drawback in its field is worthy of comment. Such tendencies undoubtedly impose hardships on the small independent manufacturer. On this score the probable trend of anti-trust legislation under the new administration offers at least a cheering prospect. Another complaint comes from electric appliance manufacturers whose business is injured by those central-station companies which sell energy-consuming devices at cost or below, thereby setting up unfair competition with independent dealers. Promise of relief in this direction comes from the recently inaugurated co-operative movement, which is apparently gaining headway in various sections of the country. The great strides in the electric-vehicle industry have had a natural effect on the storage-battery business and the output has increased to a very notable extent. Wire manufacturers send in favorable reports, and the outlook appears to be good aside from the possibility of tariff reductions. Pole dealers report the practical exhaustion of the Michigan cedar supply and are turning to Western timber. The predominant notes of uncertainty over the future relate to tariff revision in the next Congress and the probable course of anti-trust legislation.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS.

A meeting of the American Institute of Consulting Engineers for the purpose of discussing the subject of "Professional Relations" will be held at the Engineers' Club, 32 West Fortieth Street, New York City, on Thursday evening, Dec. 12, at 6:30 o'clock. It is the intention to have this a dinner meeting, and the members have been especially urged—in view of the importance of the topic for discussion—to attend. Three vacancies will occur in the council in January, and a special nominating committee, consisting of Messrs. Lindenthal, Feldman and Hutchinson, appointed at the last meeting of the council, has submitted the following nominations: Messrs. Henry Holgate, Montreal; Daniel Moran, New York, and Charles Sooysmith, New York. The newly elected members of the council will serve until January, 1916. Mr. Eugene W. Stern is secretary of the institute, with headquarters at 103 Park Avenue, New York City.

DECISION FOR CONDIT COMPANY IN CIRCUIT-BREAKER SUIT.

On appeal from the District Court of the United States for Massachusetts, the United States Court of Appeals, First Circuit, has reversed the ruling below and handed down a decision favorable to the Condit Electrical Manufacturing Company in the suit brought by the Westinghouse Electric & Manufacturing Company for alleged infringement of the Wurts patent for a circuit-interrupting device. The appeal to the higher court related to claims 3 and 4 of the Wurts patent, No. 570,416, issued Oct. 27, 1896, which are:

"3. The combination with a plurality of systems of electrical distribution provided with circuit-interrupting devices, controlling magnets and normally open local circuits therefor fed by an independent source of current, of means actuated by an excessive current in any one of the main circuits for closing the corresponding local circuit, and a plurality of circuit-closing devices located at a distant point and each operated at will to close the corresponding local circuit.

"4. The combination with a plurality of systems of multiphase electrical distribution provided with circuit-interrupting devices, one for all of the phases of each system, and controlling magnets therefor, of a local circuit for each of said magnets, means actuated by an excessive current of any phase to close the corresponding local circuit, and a plurality of switches independently operated at will to close any one of said local circuits."

In the Westinghouse brief, which is quoted by the court, it is stated that "the novelty (of the patent in suit) lies not in a specific mechanism, but in the mode of operation or result brought about by a new combination of devices which separately were entirely familiar to the electrical art."

The complainant's contentions are rejected by the court as being open to these two objections:

"First, that the claims are not for true combinations, but for a mere multiplication of similar and independent devices—for aggregations and not for combinations; second, that the features of each system, even if novel, do not involve patentable invention; in other words, that no invention is involved either in the single device or in a pair of such devices."

The present suit is one of a number of related cases, two of which were filed by the Westinghouse company and two by the General Electric Company on the same date. All of these cases have, so far as they have been carried, been decided in favor of the Condit company except the one involving the first Wright and Aalborg patent.

CONFERENCE ON WATER-POWER REGULATION.

An informal conference on water-power regulation was held by Secretary of the Interior Fisher, in Washington, D. C., on Nov. 18 and 19, at which there were present representatives of the State of California, Pacific Coast power companies and others interested in the subject. The concerns represented included J. G. White & Company, Stone & Webster, E. H. Rollins & Sons, California-Nevada Power Company, Great Western Power Company, Southern California Edison Company, Mount Whitney Power Company, Northwestern Electric Company of Oregon, Washington Water Power Company, Great Falls Power Company, Northern California Power Company, Twin Falls Land & Water Company and the Central Colorado Power Company. Among the prominent individuals who took part in the discussion were Messrs. Oscar T. Crosby, Washington, D. C.; Richard M. Saltonstall, Boston; Josiah Newcomb, New York; H. H. Trowbridge, Los Angeles; Guy C. Earle, San Francisco; D. L. Huntingdon, Spokane; C. F. Kelley, New York and Butte, and W. P. Lay, Gadsden, Ala. Several officials of the federal and state governments also took part in the discussion, including Secretary Fisher in person, Commissioner John M. Eshleman, of the California Railroad Commission, and Prof. Charles D. Marx, of the State Water Commission.

The conference occupied two full days, with a discussion of the general principles which should govern federal water-power legislation and administration and specific criticism of the regulations issued last August. It is not quite five years since a similar conference was held, at which Secretary Garfield and other federal officers discussed the same fundamental issues. The representatives of the power companies then asked for perpetual grants at merely nominal acreage charges and free from any obligation to pay rental or submit to governmental supervision. That conference failed to reach an agreement on this point, and the respective factions then centered their efforts at having legislation enacted which would put their policies in force.

The State of California has created, in addition to its Railroad Commission, which has jurisdiction over public utilities, a Conservation Commission, the chairman of which is former Governor Pardee, who was also a member of the National Conservation Commission. There has also been created a State Water Commission, which now has for its chairman Prof. Charles D. Marx of Stanford University, a hydraulic engineer of distinction. These state officials suggested the present conference. In California, as in other Pacific Coast states, the water-power sites are largely under federal ownership, while the disposal of the water rights is by federal statutes and regulations, governed also by the procedure established by state laws. The developer of water-power must, therefore, deal with two sovereignties, and the new policy of effective state control requires action in harmony with that of the federal government. Before the conference was held, however, the Interior Department issued new water-power regulations, wherein for the first time it attempted such comprehensive control as is possible under the existing, but admittedly inadequate, law of 1901. These regulations were in general harmony with but somewhat more severe than the regulations of the Forest Service, and Secretary Fisher desired the criticisms and suggestions of practical water-power men with a view to such amendments by both departments as might appear to be necessary. General invitations were sent to the principal power companies operating in the West and to the National Electric Light Association, the American Institute of Electrical Engineers, the National Conservation Association and others interested. The N. E. L. A. and the A. I. E. E. did not, however, have representatives in attendance. It was expected that Mr. John A. Britton, of San Francisco, would speak in behalf of the N. E. L. A., but

owing to the postponement of consideration of some of the questions that were to come up for discussion he did not attend.

State rights arguments on which the opponents of public control vested their case some years ago were presented anew by Mr. Lay, and the policy of local rather than federal control was also urged with much force by Messrs. Crosby, Trowbridge and Earle. Secretary Fisher analyzed their arguments and took up separately the problem of rentals and the control of rates and service. He made it clear that his policy was based upon the principle of insuring the distribution of the benefits of natural resources to the ultimate consumers in the form of lower rates and better service. He recognized that where steam competition is not present and competition between water-power sites is practically abolished by single ownership or control, effective regulation of the resulting monopoly is quite possible, but, in his opinion, the power to charge rentals should be preserved to the federal government for the further reason that defective state laws or lax administration on the part of the State may fail to protect the public from extortion. In the last event, he claims, the power to adjust rentals every ten years, as contemplated by the new regulations, will be a strong stimulant to the reduction of rates, and, failing that, will at least transfer a considerable portion of the undue profits to the public treasury as further contributions toward the conservation expenses.

Rentals prescribed by the new regulations were the object of some criticism. Mr. Earle and Mr. Huntingdon considered that the ordinary rental of $1 per hp, which is to be reached by successive increments throughout the first ten years, creates a heavy burden on the enterprise and might amount to as much as 4 per cent on the gross receipts. Chief Engineer O. C. Merrill, of the Forest Service, replied that a tax based on the hydraulic horse-power developed and another on the horse-power demand of the power company's load were two distinctly different things, and declared that the actual rental would amount to only 1 per cent of the gross receipts. Secretary Fisher stated that the minimum rental prescribed by the regulations to be paid the tenth year is 10 cents and not $1, and that the regulations empower the department to adjust the rental as may be warranted by individual circumstances.

The new regulations insure state control of rates and service by a provision that failure to obey reasonable requirements made by state authorities shall be deemed adequate cause for revocation of the federal permit. This provision was vigorously objected to by Messrs. Trowbridge and Crosby. Opinions differed as to whether the Secretary of the Interior, having reached the same conclusion as the state authorities, could revoke a permit without awaiting the action of the federal courts, it being argued that the Fourteenth Amendment of the Constitution could be invoked in such a case to insure the investor against confiscation of his property. Secretary Fisher insisted that there is great necessity for terminating frivolous litigation in the federal courts whereby the powers of state commissions are nullified through needless delay, and declared that a power company should put its whole case before the state commission and, in the event of defeat there and in the higher state court, should appeal directly to the United States Supreme Court, under the Fourteenth Amendment.

There was some criticism of the details of the regulation which binds the permittee to sell at a fair valuation to the state or any municipality desiring to purchase, but the correctness of the general principle was admitted. The desirability of some impartial and effective method of determining valuation in such cases was conceded by the federal officials. Secretary Fisher said that his department approves of the general provisions of the pending Burton bill to regulate water-power development on sites owned by the federal government and considers them consistent with the regulations under discussion and in accord with the views generally expressed at the conference. He also requested specific criticism of the measure before the Interior Department responds to the formal request from the Senate committee on commerce for report thereon. It is believed that one outcome of the conference is likely to be simplified procedure, whereby state and federal officers will act in harmony and with dispatch.

CO-OPERATION OF CENTRAL-STATION MEN AND ELECTRICAL CONTRACTORS IN CHICAGO.

The good-fellowship dinner given by the Commonwealth Edison Company to leading electrical contractors of Chicago on the evening of Nov. 23 was a gratifying success. It was served in the beautiful Italian room of the Hotel Sherman, the total attendance being 115, of whom seventy-five were contractors and forty Edison men. Small tables were used, and three central-station men and five contractors were seated at nearly all of these. The dinner was high class in all its appointments, and at its conclusion a number of speeches were made, Mr. John F. Gilchrist, of the Edison company, acting as toastmaster. Others who spoke were Messrs. Ernest Freeman, president of the National Electrical Contractors' Association; J. P. Kearns, president of the Faraday Electrical Association (composed of the outlying contractors); C. R. Kreider, president of the Chicago Electrical Contractors' Association; G. A. Edward Kohler, of Kohler Brothers; A. S. Schulman, contractor; Peter Junkersfeld, of the Edison company; E. W. Koyd, of the Edison company; William McGuineas, contractor, and J. N. Pierce, contractor. The speeches were all couched in the happiest vein of "Here's to our better acquaintance," and the meeting was most harmonious throughout, forming an auspicious beginning to an era of better understanding between the electric-service interests and the electrical contractors in Chicago. During the evening the Edison Quartet sang several songs, and the party lingered late for an informal talk on co-operation.

SECOND KENNELLY LECTURE ON HYPERBOLIC FUNCTIONS.

On Nov. 14 Dr. A. E. Kennelly delivered before a large audience his second lecture at the Brooklyn Polytechnic Institute on the application of hyperbolic functions to electrical engineering. The subject announced for the evening was "The Behavior of Direct-Current Lines of Uniform Linear Conductor Resistance," consideration of which had been prepared for by the discussion of the properties of hyperbolic functions in general at the first lecture, given on Oct. 10. While the most important application of these functions is in the case of alternating-current transmission lines, Dr. Kennelly explained that the consideration of direct-current lines in the steady state forms a natural and easy introduction to the more difficult alternating-current case, and, moreover, the formulas in the first instance apply at once to the latter case if interpreted vectorially. As before, the lecturer delivered his discourse almost entirely from lantern slides, illustrating the properties of both uniform and non-uniform lines possessing linear resistance and leakance, in the steady state.

Commencing with the simple case of perfectly insulated lines, the speaker exhibited curves showing the potential characteristics under different conditions at the distant or receiving end. He then passed to the case when leakance is included and showed how the straight-line characteristics of the first case change to curves which conform with the law of the catenary. The hyperbolic formulas for the solution of problems relating to such uniform lines were

then presented and explained. Dr. Kennelly next took up the subject of equivalent circuits of uniform lines in the steady state, or artificial lines, as they are more commonly known. There are two general types, termed respectively a "T" line and a "Π" line, according as the leakage arm of each section is grouped in a single resistor and connected to the center of the line section, or divided into two equal parts, one at each end of the line section. The speaker then presented hyperbolic formulas for computing the resistance and leakance of an artificial line to give the same over-all characteristics as a real or uniform line, and showed graphically how closely the two resemble each other at all points. Finally the lecturer compared the hyperbolic method of calculation with the trigonometric method presented by a well-known engineer several years ago in a paper before the American Institute of Electrical Engineers, to illustrate the comparative brevity and simplicity of the former method in handling numerical work. The only obstacle, said Dr. Kennelly, to a general use of the hyperbolic method is the lack of a table of the hyperbolic functions of complex angles, but these are now in the course of preparation and it is hoped to have them ready for publication within a year.

NEW YORK ELECTRIC VEHICLE ASSOCIATION PROGRESS.

At the November meeting of the directors of the New York Electric Vehicle Association, details of the formation and purposes of which were given in these columns Sept. 21, 1912, Mr. Harvey Robinson, of the New York Edison Company, was made treasurer of the association and Messrs. Henry C. Fling and Arthur H. Miller, of the same company, were appointed secretary and publicity representative respectively.

As noted in earlier accounts, the president of the association is Mr. Arthur Williams, of the New York Edison Company, and the vice-president is Mr. William P. Kennedy, of the Baker Motor Vehicle Company. Those present at the November meeting were Messrs. Williams, Kennedy and Robinson; Nathaniel Platt, Baker Motor Vehicle Company; C. Y. Kenworthy, Rauch & Lang Carriage Company; J. H. Kennard, Couple-Gear; S. W. Menefee, Anderson Electric Car Company; C. A. Ward, Ward Motor Vehicle Company; E. W. Curtis, Jr., General Vehicle Company, and J. H. Cafferty, General Motors Truck Company.

President Williams called attention to the lack of good electric vehicle garage facilities in New York City and to the many benefits to be derived from closer co-operation among dealers in conducting sales campaigns.

In keeping with the plans of the association for obtaining a building which will be used as a co-operative garage, showroom and offices for the association and for the various companies in it, a committee was appointed to consider available buildings for this purpose. This committee is composed of the following: Messrs. Kennedy, Platt, Kenworthy, Cafferty and Menefee; M. L. Case, of the Lansden Company, and A. B. Roeder, of the International Fritchle Company.

After extensive discussion as to the best lines along which the association can direct its efforts for helping the electric-vehicle industry in New York, the following committees were appointed:

Committee on Advertising and Publicity—Messrs. E. W. Curtis, Jr., J. H. Kennard, S. W. Menefee, George H. Phelps, Studebaker Automobile Company; V. A. Villar, Champion Electric Vehicle Company, and W. R. Chandler, Holt-Chandler Company.

Committee on Charging Stations—Messrs. W. P. Kennedy, Nathaniel Platt, C. Y. Kenworthy, C. A. Ward, Harvey Robinson; J. L. Wiltse, Edison Electric Illuminating Company of Brooklyn; S. G. Thompson, Public Service Corporation of New Jersey; J. E. Phillips, Richmond Railway & Light Company, Staten Island, N. Y.; W. E. McCoy, United Electric Light & Power Company, New York, and W. L. Secord, Westchester Lighting Company, Mount Vernon, N. Y. This committee is to see to the establishment of charging stations in proper locations, to the preparation of lists of such stations and of road maps, and to the erection of garage signs.

Committee on Operating Costs—Messrs. W. P. Kennedy, E. W. Curtis, Jr., Charles A. Ward, J. H. Kennard and Nathaniel Platt. This committee is to investigate, compile and make ready for public distribution tables showing the relative costs of horse, gasoline and electric operation.

Committee on Traffic and Service Runs—Messrs. E. W. Curtis, Jr., J. H. Kennard, J. H. Cafferty, S. W. Menefee, C. Y. Kenworthy, Nathaniel Platt; J. P. Fitzsimmons, of John Wanamaker, New York, and R. G. MacDonald, Hupp-Yeats Electric Car Company. This committee is to arrange and direct public exhibitions and test runs and to establish parking spaces in shopping, hotel and theater districts.

Committee on Membership—Messrs. J. H. Cafferty, C. A. Ward, S. W. Menefee and C. Y. Kenworthy. This committee is to solicit new members, whose qualifications will be passed upon by the board of directors.

Following the appointment of these committees the president presented for consideration a list of people who had applied for tickets for admission to view the automobile exhibits at the recent New York Electrical Show, as a result of the association's newspaper advertising at that time. The acting secretary was directed to have copies of this list prepared and sent to all vehicle dealers.

RAILWAY WAGE REGULATION.

The findings of the Board of Arbitration between the steam railways east of Chicago and their locomotive engineers, while not of specific interest to the electrical industry generally, are nevertheless important because of the fundamental principles involved and some of the points brought out by the board. Leaving aside the question of the wage scale in its details, there is much interest in the broad principle that a wage burden on the railways which impairs the earnings of a fair return on the investment should be recouped by such increase in the charges for freight or passenger service as may be necessary and warranted. The board appears to take the broad view that the public interest in this question is superior to the selfish demands of either capital or labor, and that the continuity of service which is so essential to the public welfare imposes obligations on both the investor and the worker.

Aside from the broad principles involved and far-reaching effect of the decision on transportation service in general, the decision contains but little which refers specifically in any way to the electrical industry. In a few cases, however, and to a somewhat limited extent, a labor problem has arisen in connection with the electrification of steam trunk lines, relating to the precedence of locomotive engineers for positions as drivers or motormen on electric locomotives and multiple-unit trains. In this connection the award of the Board of Arbitration provides as follows:

"Whenever electric service is installed as a substitute for steam, or is now in operation on any of the railroads parties to this arbitration, or on any of the tracks operated or controlled by any of them as part of their system, the locomotive engineers shall have the preference for the positions of engineers or motormen on electric locomotives or multiple-unit trains; but this right of the engineers shall not operate to displace any man operating electric power on any of the railroads parties to the agreement on May 1, 1912."

ELECTRIC SHIP PROPULSION.

At the twentieth general meeting of the Society of Naval Architects and Marine Engineers, held in New York City Nov. 21 and 22, Messrs. William T. Donnelly and George A. Orrok, members of the society, presented a paper entitled "An Electrically Propelled Fireproof Passenger Steamer." This paper is copyrighted by the society, and with its permission we are presenting an extended abstract of it in what follows:

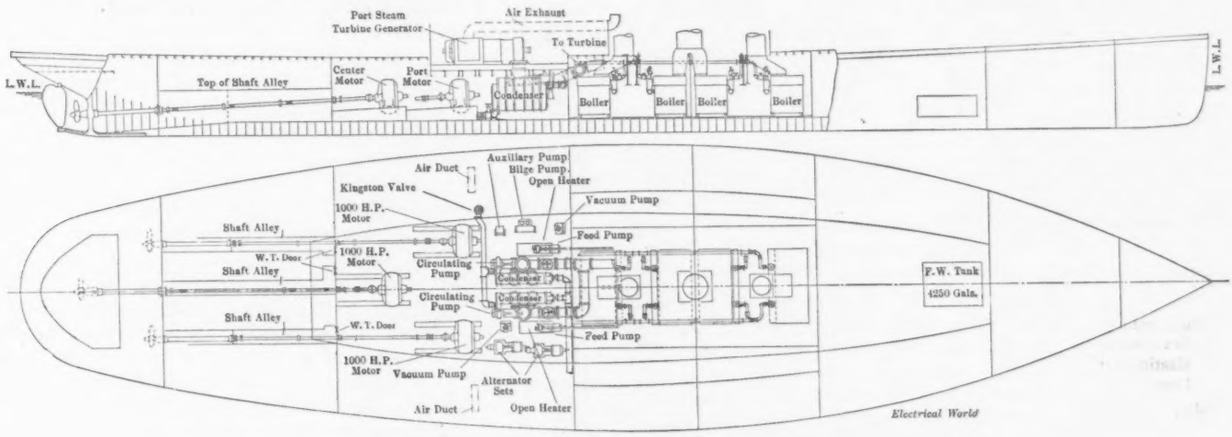
The authors in their introduction sketch the remarkable advances in the art of marine transportation from the days of the *Clermont* in 1807, which was a vessel 150 ft. long with 13-ft. beam, propelled by side paddlewheels with an expenditure of about 25 hp, to the most modern passenger boats navigating the same historic river from New York to Albany, which are 384 ft. in length and use approximately 6000 hp each. These boats, which represent the very last word and the highest skill in naval architecture, make the 140-mile run in nine hours and have a capacity of 5500 passengers, which is the greatest number that can be carried by any vessel in the world.

Soon after the period of the *Clermont* the American type of low-pressure walking-beam engine was developed, which, strange as it may seem, has persisted practically without modification to the present day for one particular class of service. The authors refer here to the steamers used during the short summer season exclusively for carrying passengers. At the present time there are twelve or fifteen steamers of this class in New York harbor which are from thirty-five to fifty years old. The oldest and most representative vessel of this class—the steamer *Grand Republic*—was built in 1878, but the engine in use in this boat was then taken from another vessel and is believed to be from fifty to sixty years old. It has a 72-in. cylinder, 12-ft. stroke, and at 16 to 17 r.p.m., with 30 lb. initial steam pressure and a 26-in. vacuum, develops approximately 1400 hp.

The authors dwelt at some length upon the characteristic features of these vessels as a class, particularly from the ship-construction side, and emphasized their general lack of such safeguards as double bottoms, bulkheads and fireproof superstructures. The authors stated that their object is not only to bring these conditions to attention but to point out how this class of vessels can and should be brought up to the standards of present engineering practice.

They then presented plans for a vessel of approximately the same over-all dimensions and passenger capacity as the *Grand Republic*. The hull is 275 ft. long over all, 260 ft. on the water line, with an extreme beam of 68 ft. and a molded breadth at the water line of 45 ft. 8 in., and is designed to have a displacement of 1714 tons, with a 10-ft. draft. The hull is designed to have a double bottom for a length of 188 ft. and double sides carried up to the deck for 109 ft. Seven watertight bulkheads carried up to the deck, without bulkhead doors, are provided for. It is also planned to provide coal-bunker space on each side of the boilers with semi-watertight doors.

The most interesting feature in the design to electrical engineers is the use of steam turbo-generators and electric motors for propulsion. Regarding this method of driving ships, the authors say it is very apparent that this marks the beginning of the broadest application of electricity to marine transportation. They remark that it took from 1765, when James Watt perfected the steam engine, until 1807 to adapt it to ship propulsion, and declare it not surprising that it has taken from 1876, or about the period of the first transmission of electric energy for driving distant electric motors, until 1912 to realize the possibilities of electric energy in marine propulsion. The authors propose to revolutionize the methods of controlling a ship's power by adopting electric propulsion and controlling the motors directly from the pilot-house, doing away with the cumbersome method of transmitting signals from pilot-house to engine room. They argue that this will lessen the division of responsibility for control of the ship, and in the course of substantiating their statement they refer to the satisfactory and safe operation of long electric trains by the multiple-unit system, under complete control from a single point.



Cross-Section and Plan of Electrically Propelled Ship.

Plans for the engine room contemplate two horizontal turbo-generator sets, each having a capacity of 1500 kw, at 80 per cent power factor. Each of these alternating-current generating units will have an exciter directly connected to the main shaft. The exciter regulation will be automatic in its character, requiring attention only during the starting and stopping of the unit. One 25-kw independent turbo-exciter will be provided for emergency use and also for supplying energy for electric lighting at times when the main units are not in service. Directly beneath each turbine will be a surface condenser with 3000 sq. ft. of cooling surface. The necessary auxiliaries, including feed pumps, bilge and fire pumps, etc., will also be placed below the turbines. The condensers are designed to maintain a 28-in. vacuum, with 70-deg. cooling water. Under normal conditions the turbine-driven circulating pumps will deliver 5000 gal. per minute through the condensers. Hot-well pumps, having a capacity of 150 gal. per minute against a 50-ft. head, will be mounted on the same shaft as the circulating pumps, both being of the centrifugal type. Air pumps will be installed in the wings on either side of the condensers. Two turbine-driven centrifugal feed pumps, with a capacity of 200 gal. per minute against a 700-ft. head, will be provided, and also bilge and fire pumps and a fresh-water tank pump for the make-up feed. Above the feed pumps are two open heaters, each having a capacity of 50,000 lb. of water per hour, heated with exhaust steam from the auxiliaries. The turbine-driven auxiliaries have been proportioned to

furnish about 90 per cent of the steam required to heat the feed water to 208 deg. Fahr.

Each of the two fire rooms is planned to contain four water-tube boilers in two batteries, located forward of the machinery space. Each boiler is designed with 1635 sq. ft. of heating surface and 44 sq. ft. of grate surface. The steam pressure will be 250 lb. and a moderate degree of superheat is provided for. The coal bunkers are in the wings on either side of the batteries. The boilers are served by three stacks, one for the forward pair, a large one for the middle four boilers and one for the after pair. These stacks are 6 ft. 6 in. and 8 ft. in diameter, and rise 72 ft. above the grates. The steam main is in duplicate with cross-connections similar to the feed-water main. The steam piping is of steel pipe with Van Stone joints, steel flanges, fittings and valves. All boiler connections have two valves between the boiler and the pressure main, and automatic stop-check valves are included.

Immediately astern of the condensers are three 1000-hp induction motors and the thrust bearings. The motors have twenty-four poles each and a normal speed of 300 r.p.m. Collector rings are provided for controlling the speed by means of external secondary resistance. The motors and generators are so designed that the short-circuit current will not exceed two and one-half times the full-load current. The controllers for the motors are placed in the pilot-house and are fitted with interlocking devices as well as an automatic timing device. All the motors may be started, brought to any speed within the full-speed range, reversed or stopped by the manipulation of the three controller handles, one for each motor. Signaling devices in addition are provided in both engine room and boiler rooms, besides the usual bell and speaking tubes. The authors give the following recapitulation of machinery:

LIST OF MACHINERY.

	Weight in tons.
Eight water-tube boilers:	
Grate surface, 44 sq. ft.; 352 sq. ft. total Heating surface, 1635 sq. ft. each; 13,080 sq. ft. total Pressure, 250 lb.	105.0
Main generating units:	
Two three-phase, 60-cycle, 1500-kw, maximum twenty-four-hour rating, 35 deg. C. rise, 3600 r.p.m., 2200-volt, 80 per cent power-factor	57.5
Three 1000-hp induction motors, 24-pole, 300 r.p.m.	33.5
Three sets of switches and controllers	20.5
Two condensers, 3000 sq. ft. cooling surface each Two combination turbine-driven centrifugal pumps	25.0
Two independent exciter sets	3.0
Two turbine-driven centrifugal feed pumps, 200 gal. each	2.0
Two bilge and fire pumps, 150 gal. Two tank pumps, 50 gal.	1.5
Two air compressors for 10-lb. pressure	4.0
Steam and other piping	5.0
Two open heaters, 50,000 lb. per hour	2.0
Three propeller shafts	11.5
Three propellers	3.0
Steel foundation for supporting machinery	25.0
Total weight of machinery	298.5

All auxiliary machinery is in duplicate and turbine-driven units are used as far as possible. The total weight of the machinery, including propeller, shafting, auxiliaries, switchboard, boilers, piping, etc., will probably not exceed 300 tons, or approximately 200 lb. per motor horse-power. The saving in deck space due to the substitution of screw propulsion for paddlewheels will be about 4000 sq. ft., while the saving in weight over the vertical beam engine with return-tubular boilers is even more marked, as the average of a number of these boats gives for the machinery weights a figure of 0.20 ton to 0.25 ton per indicated horse-power. The coal consumption on vessels of the *Grand Republic* type is not far from 3.25 lb. per indicated hp-hour under test conditions and somewhat in excess of this figure in ordinary operation. The vessel described by the author should give test results approaching 1.5 lb. of coal per indicated hp-hour. Taking a basis of ten hours per day at full power for 100 days per year, corresponding to the summer excursion season, the saving in coal would amount to 3000 tons, which, at $3 per ton, would save $9,000. This amount, capitalized at 10 per cent, would warrant an additional investment of $90,000, which the authors state would more than cover the difference between the cost of the present type of boat and the one they propose. Besides the fuel saving there will be further economy in the matter of oil and general maintenance charges incidental to operating marine engines. Inasmuch as these vessels are not cargo boats the savings which would result from diminished machinery space and increased cargo room do not figure in the comparison. Among other advantages of vessels of the proposed type is the great facility with which the turbo-generator units may be utilized while the vessel is tied up at dock, supplying electric energy for driving motors on board or delivering energy ashore for any desired purpose. It would be possible in this way to make use of the ship's machinery during the idle season of eight months and thus keep part of the investment active throughout the entire year.

ANTHRACITE COAL SITUATION.

The Merchants' Association of New York has just completed an investigation into the anthracite coal supply which indicates strongly the fictitious nature of the "scare" that has been raised over the possibility of an anthracite coal famine. Investigations in the coal regions have revealed the fact that about 86 per cent of the entire production of anthracite coal is controlled by the so-called railroad coal companies and that no advance has been made nor will be made in the official price affecting 86 per cent of the supply. The remaining 14 per cent is controlled by the so-called independent operators and it is this independent product which is the subject of speculation. In general the output of the anthracite mines for some months past has been greater than ever before and the large deficit caused by closing the mines in April and May has already been covered. During the next three months the aggregate production will reach normal, in which case there will be sufficient coal on hand to meet every reasonable demand. It might be pointed out in this connection that owing to the growing scarcity of the buckwheat sizes of anthracite, the price has naturally increased from time to time so that many central-station companies in the East now use bituminous coal exclusively.

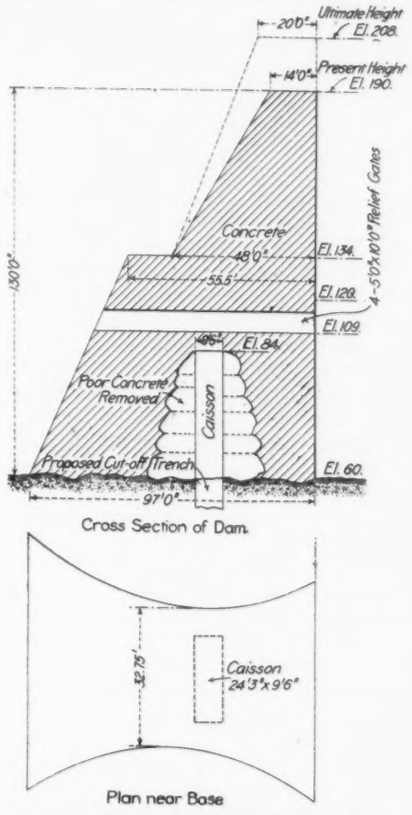
DEARBORN STREET LIGHTING IN CHICAGO.

After extended negotiations between the city of Chicago, the Sanitary District of Chicago the committee on down-town streets of the Chicago Association of Commerce and the Dearborn Street Improvement Association, an arrangement has been concluded, apparently, by which a number of additional arc lamps will be installed for the lighting of Dearborn Street between Polk Street and Lake Street in Chicago. It is proposed to install 107 lamps in this "down-town" portion of the street, which is about a mile long. The city's general plan for street lighting provides for twenty-nine arc street lamps in this portion of the street. It has been agreed, however, that the city shall furnish to the Dearborn Street Improvement Association the extra seventy-eight lamps, billing that association monthly for the actual cost of maintaining and operating these extra lamps. The city is effecting a saving, because, while it furnishes 107 lamps instead of twenty-nine, the association undertakes to furnish the standards for the 107 lamps, so that the net cost to the city will be less than under the original plan.

CAUSES OF WASHOUT AT OLYMPIC POWER COMPANY'S DAM.

Additional data are now at hand concerning the causes contributing to the failure of the dam on the Elwha River near Port Angeles, Wash., of which mention was made in the *Electrical World* for Nov. 23. The dam was constructed to store water for use in a hydroelectric plant and the site is at a narrow gorge about 40 ft. wide at the bottom. The sides of this gorge ascend very steeply from the water level and then flatten out to moderate slopes. The normal flow of the Elwha River is about 1500 second-ft., although a maximum flood flow of about 23,800 second-ft. was recorded in 1901. The stream bed at the site is at an elevation of 60 ft. and the water level generally at an elevation between 80 ft. and 84 ft.

The upper part of the structure was uninjured and was left like an arch, spanning the narrow stream, while the



Cross-Section and Plan of Dam.

water of the river flowed underneath through the breach, about 40 ft. wide. The washout was due to the fact that the cut-off wall had not been carried down to a firm foundation through the sand and gravel of the stream bed, so that water found its way underneath and through the base of the dam and carried the foundation material away, leaving no support for the structure on the bed of the stream.

The dam is of solid concrete masonry with spillways at either side and four large gates over the deep channel for reducing the level of the reservoir. The dam extends across the narrowest part of the stream, and both the plan and front elevation have a shape like an hourglass, so that as long as the material forming the abutments remains in place the concrete structure is firmly wedged in. The original bed of the stream was at an elevation of about 60 ft. and the top of the dam at an elevation of 190 ft., giving a height, therefore, of about 130 ft. The ultimate design for the structure, however, contemplated carrying the height up an additional 18 ft. to an elevation of 208 ft. The top width of the transverse section at an elevation of 190 ft. is 14 ft.; at the base, at an elevation of 6 ft., it is slightly less than 100 ft. as designed. The upstream face is almost vertical while the downstream side slopes, as shown in the accompanying drawing. At an elevation of 112 ft. are the four 5-ft. by 10-ft. relief gates above referred to. The dam was designed of gravity section, but it was thought there was no possibility of its sliding or overturning because it was wedged in between the canyon walls.

In the base of the dam, shown in the illustration, the portion indicated as "poor concrete" had been removed and a caisson 24 ft. 3 in. by 9 ft. 6 in. had been sunk in an attempt to stop a leak on the downstream face. The excavation of the caisson disclosed the character of the masonry at the center of the structure, and it is said to have been possible to scoop out handfuls of the original concrete mixture from which the cement had been washed out. Compressed air at about 15 lb. per sq. in. was used in sinking the caisson, and as the excavation progressed downward the soft concrete was removed and the space filled in again with stronger material down to level of the bed of the stream. In this manner, working under compressed air, the excavation was carried down below an elevation of 52 ft. It was apparent that the material in the base of the dam, instead of being concrete, was more nearly a mixture of sand and gravel. When the cut-off trench had been carried down to what was thought to be a sufficient depth an attempt was made to seal it, but as soon as the air pressure was taken off the water within the caisson rose rapidly, giving proof that the leakage had not been checked entirely. Nevertheless, the concreting was continued.

The dam was inspected in June, 1912, and again in August in behalf of the owners, and after each inspection they refused to accept the work as it then stood. Two months after the second examination had been made, during which time the cut-off wall was carried down further, the washout occurred. A large hole was made in the stream bed by the rapidly moving current of water, and the power house and its equipment at one side below the dam were damaged considerably. The torrent carried away a bridge on one of the main county roads two miles below the plant, but there was no loss of life. The main structure remained intact, bridging the stream, but there is a hole under the dam over 60 ft. in depth.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO.

Nearly 150 representatives of electrical manufacturers and jobbers in Chicago and other cities attended the seventeenth annual meeting of the Electrical Credit Association of Chicago, held in the clubrooms of the Chicago Athletic Association Nov. 21. In his presidential address Mr. S. E. Kennedy pointed out that, while it is beyond the function of the association to obligate its members not to sell goods to purchasers found delinquent in previous dealings with other members, common business prudence on the part of these firms will serve the same end by dictating the withdrawal of credit from those who have abused it in the past. The speaker also warned against the irresponsible class of small tradesmen whose business abilities and methods fit them for the workbench rather than for recognition as business men. In closing, President Kennedy expressed confidence that the credit association is fulfilling the purposes for which it was organized.

Mr. James Wolff, representative to the national association, urged against affiliation with the jobbers' association. The report of the secretary-treasurer, Mr. Frederick P. Vose, Chicago, showed a present membership of 210 and collections through the association averaging $1,100 per member. Nearly 7000 names appear on the delinquent list furnisched to members. After a report from Mr. Henry Schwab, of the committee on membership, the recommen-

dations of the nominating committee, presented by Mr. J. N. Macalister, Chicago, were unanimously accepted, the former officers being re-elected as follows: President, S. E. Kennedy, Central Electric Company, Chicago; vice-president, A. O. Kuehmstead, Gregory Electric Company, Chicago; national representative, James Wolff; additions to executive committee, T. I. Stacey, Electric Appliance Company, and A. O. Kuehmstead, Gregory Electric Company, Chicago.

"The Relation of the Credit to the Sales Department from the Viewpoint of the Credit Manager," a paper by Mr. S. H. Anderson, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., was read in the author's absence by Mr. R. M. McConnell. A policy of over-conservatism, said the writer, results only in the loss of the profit on the sale turned down. But, on the other hand, too liberal a view of credits may cause the loss of goods, profit, sales effort and all. Although most credit managers are conservative by nature, they spend on the average much more time considering the cases they turn down than the ones they pass. The salesman is always an optimist as long as the possibility of a sale is in sight, but on the credit man rests the responsibility of finding out whether the customer has funds to liquidate.

Discussing the same subject from the point of a sales manager, Mr. T. G. Ringgold, Central Electric Company, Chicago, said that few credit managers know the difficulties of the salesman and the brains and energy he expends in winning first the customer's friendship and later his order. The speaker urged credit managers to get out into the field and meet the man on whose credit they pass.

Mr. H. Larsen, Illinois Electric Company, Chicago, followed with a discussion of the bad habit of extending credit and terms beyond reasonable limits, especially to the contracting trade. Contractors, he said, often lack the tangible security which would be demanded in similar transactions measured by the standards of other trades. The method of making 80 per cent payments as the work is completed often results in delaying the contractor's profit and causes embarrassment all along the line. Mr. Larsen spoke in favor of a properly organized credit bureau in the electrical trades, urging upon his hearers the value of such a clearing house of credit and ledger information.

"Terms of Sale" was the title of a paper by Mr. Gordon E. Varney, Varney Electrical Supply Company, Indianapolis, Ind., in which he emphasized the point that no profit can be realized until the account is collected. Too often, he said, the sales department loses sight of everything else except the taking of orders. Terms accepted as basis for credit should be insisted on as rigidly as the terms imposed by banks in making loans.

The use and effect of the revised forms prepared by the association were discussed in a series of communications submitted and read before the meeting by Messrs. H. L. Walker, Detroit, Mich.; G. C. Besold, Gregory Electric Company, Chicago; T. J. Whearty, National Carbon Company, Cleveland, Ohio; M. A. Curran, Western Electric Company, Minneapolis, Minn.; Edward Pfleger, Julius Andrae & Sons Company, Milwaukee, Wis.; B. B. Downs, St. Paul Electric Company, St. Paul, Minn., and Clyde Minor, Cleveland, Ohio.

Mr. E. E. Ingles, B-R Electric & Telephone Company, Kansas City, Mo., followed with an account of trade conditions in Oklahoma and their bearing on electrical credit matters.

At the dinner in the evening with Secretary Vose acting as toastmaster, the following addresses were made: "Public Utilities and Public Relations," by Mr. Harold Almert, H. M. Byllesby & Company, Chicago; "The Law and the Profits," by Mr. William C. Sprague, Detroit, Mich.; "Capital, Capacity, Character," by Dr. Emil G. Hirsch, Chicago, and "The Whirligig of Time," by Colonel W. L. Visscher, Louisville, Ky.

SUPREME COURT OPINION IN THE "BATHTUB TRUST" CASE.

Brief mention was made in our issue last week of the recent opinion handed down by the United States Supreme Court in the so-called "Bathtub Trust" case, which is of great interest in connection with the patent situation. The case is more properly known as the United States versus the Standard Sanitary Manufacturing Company et al., appealed by the defendants from the decision of the United States District Court for the district of Maryland, given in favor of the government. The original action charged the appellants with violation of the act of July 2, 1890, commonly known as the Sherman anti-trust act. There were sixteen corporate and thirty-four individual defendants, the latter, with the exception of Mr. E. L. Wayman, being the officers, presidents or secretaries, of the companies. The corporate defendants were alleged to be manufacturers of enameled ironware in various parts of the country, making 85 per cent of such ware and engaged in interstate and foreign trade therein, in competition among themselves and with certain manufacturers of such ware. It was further charged that in 1909 or 1910 they entered into a combination and conspiracy to restrain this trade. The defendants denied the charges, Wayman doing so in a separate answer and the Colwell Lead Company declaring that it was not engaged in interstate commerce. The Supreme Court reviewed the case as follows:

"A great deal of testimony was taken and the case quite elaborately argued, but in the view we take of it it is in comparatively narrow compass, depending upon the application of well-settled principles. The corporate defendants are manufacturers of sanitary enameled ironware, such as bathtubs, washbowls, drinking fountains, sinks, closets, etc. The enameling consists in applying opaque white glass to iron utensils, first in the condition of a liquid and, second, in the form of a powder. The process consists in heating the utensil to a red heat and then sifting upon it the enameling powder. The powder is fused by the high temperature and forms on the utensils a hard, impenetrable, insoluble, smooth and glossy surface.

"Prior to the invention of James W. Arrott, Jr., covered by letters patent issued Sept. 26, 1899, the enameling powder was applied by a sieve attached to a long handle which was held by the workman with one hand and the sieve made to vibrate by the workman striking the handle with his other hand, thereby sifting the powder over the surface of the ironware. The implement was an imperfect one, not easily handled, and by its use the workmen were subjected to intense heat and physical strain. The flow of the powder, besides, was not continuous; it was cast upon the metal in intermittent puffs, causing in many instances an unequal distribution of the powder and producing defective articles which either had to be thrown away or sold as 'seconds.' With Arrott's invention these evil results are lessened or disappear. The sieve is mechanically vibrated very rapidly, causing, instead of an intermittent flow of the powder as in the hand process, a practically continuous flow. Both hands of the workman may be used to guide and direct the sieve. The advantages of the instrument over the hand process are decided. It is more efficient and more economical. It makes a better article and in less time. There is no waste in defects or 'seconds.' The workman is relieved to some extent from 'fierce heat conditions,' to quote from the answers.

"At the time of the contracts which are attacked by the government the Standard Sanitary Manufacturing Company was the owner of the patent and manufacturer of 50 per cent of the ware and used in its production the patented device. Some of the other manufacturers were infringing and controversies existed. Some yielded to its validity, others contested it. It was sustained by the courts in several cases."

The details of Wayman's connection with the manufacturing end of the business and the history of his efforts to obtain control of the Arrott patent, with final success, are presented in the opinion at some length. Referring to the summary of the situation by defendants' counsel, the opinion says:

"'Wayman's motive,' it is asserted, 'was to make money for himself, not as a manufacturer but as the owner of a patent, receiving royalties from those whom he licensed to use his patented invention.' The form of his license, it is further asserted, followed the precedents and was based on that principle of the patent law which gives to the owner of an invention the power to grant to others its use or to withhold it, or to grant it upon such terms as he may choose to impose. Such being his motive and such being his right, he, it is contended, negotiated with and contracted with the manufacturers of enameled ware; and their motives also are attempted to be justified, though the necessity for doing so is disclaimed.

"Wayman's right, it seems to be contended, is all-sufficient, and that the manufacturers only paid the price that he could legally demand. As the demand was legal, it is argued, the payment of the price could not be illegal. But the government asserts subterfuge, illegal purpose liveried in legal forms to give color of right to illegal practices.

"The charge challenges consideration of the relation between that which the manufacturers engaged to do and the protection of the exclusive right attached to the invention. Upon such consideration how far the licenses transcend such right and violate the Sherman law we can then determine. And we shall keep in mind and apply the principle expressed in Bement versus the National Harrow Company (186 U. S., 70, 92) that the Sherman law 'clearly does not refer to that kind of restraint of interstate commerce which may arise from reasonable and legal conditions imposed upon the assignee or licensee of a patent by the owner thereof, restricting the terms upon which the article may be used and the price to be demanded therefor. Such a construction of the act no doubt was never contemplated by its framers.'

"In our inquiry we shall accept *arguendo* the statement of defendants of their inducements and purpose. We say '*arguendo*' because the asserted inducement and purpose are denied by the government, it contending, as we have seen, that the Arrott patent was but a pretense and that the agreements were put in the form of licenses of it to at once accomplish and palliate evasions of the law. The fact being in controversy, we place our consideration and decision on other elements. In other words, we will consider the case from the standpoint of defendants' view of the situation, with comments as we proceed as to what they did to meet it and how far what they did accorded with or transgressed the law.

"The contention of the defendants then is that the Standard company's position and power as owner of the patent and Wayman's were identical. What it could have done, it is contended, he could do, and its relation to the trade and the relation of other manufacturers to the trade clearly demonstrate, it is further contended, that as that company could have made the contracts, Wayman could do so.

"To support the contention defendants represent the Standard as the dominant (it produced 50 per cent of the articles) and the only honest manufacturer, pointing out to other manufacturers the worthlessness of their output, they not having the Arrott patent; also the dishonesty of their output, they putting out 'seconds,' the inferiority of which was 'discernible only by experts'—thereby defrauding the public, 'discrediting the ware and demoralizing the market and business.' To avert these evil results, it is represented that the Standard was willing to forego the advantages which its ownership of the Arrott patent gave it and confer them upon the other manufacturers. But upon terms. 'First and foremost' it was to be agreed that no 'seconds' should be marketed. In the second place, a standard price must be agreed to so that henceforth rivalry should be 'in the quality of the ware turned out at a uniform price or in any other collateral inducement to the purchaser' that would not 'affect the quality of the ware.' Wayman's agency and office, it is represented, was that of 'watching all parties and insuring their fidelity to the agreement by the payment of a royalty for the use of the invention.' And this, it is said, is 'all there is in substance or principle to the case at bar, except that Mr. Wayman, instead of the Standard company, was the originator of the scheme and that he persuaded his co-defendants to enter into it.'

"But the scheme has other features and effects which counsel overlook or ignore. It is immediately open to the criticism that its parts have no natural or necessary relation. What relation has the fixing of a price of the ware to the production of 'seconds?' If the articles were made perfect their price in compensation of them and by unfettered competition would adjust itself. To say otherwise would be in defiance of the examples of the trading and industrial world. Nor was a combination of manufacturers necessary to the perfection of manufacture and to rivalry in its quality. And it may be asked, if such perfection and its protecting influence against deception and the ruinous depression of prices were so desirable and potent as it is contended that they were, why were they not extended to 'baths,' the most important of the articles in the trade? It is not an adequate answer to say that there was a time guarantee of them even though it was given to all of them, as it was not. The justification of defendants is based not on the responsibility of manufacturers but on the integrity of the articles assured by the use of the Arrott device.

"It is the foundation of defendants' argument that to make the use of that device universal was the prompting of Wayman's energies to unite the manufacturers and to remove the evils which beset the trade and which were 'discrediting the ware and demoralizing the market and business.' It was the representation of the advantage, we are told, of such results that broke down the resolution of the Standard company not to share the use of the device with other manufacturers. But, granting that there was provision of security against the production of 'seconds' in all of the articles, it seems from what we have said above that all of the substantial good which is asserted to have been the object of the agreements could have been attained by a simple sale of the right to use the Arrott patent, conceding to it the dominant effect which is attributed to it. Nor is the justification of defendants made more adequate by the representation that 'Wayman's motive was to make money for himself, not as a manufacturer but as the owner of the patent, receiving royalties from those whom he licensed to use his patented invention.' Wayman testified to another motive. By fixing prices 'he hoped,' he said, 'as one of the features of the license agreements, to enable the companies to abolish ruinous competition' and to get a 'revenue for each of the companies to enable them to make a reasonable profit.'"

After referring to the preliminaries in negotiating the agreements, the opinion continues:

"The license agreement was subsequently executed. It granted to the licensee the right to use in the manufacture of enameled ware the Arrott patent, also a patent to E. Dithridge for a pneumatic sieve and a patent to William Lindsay for an 'enameling powder distributor.' It released the claims for past infringement so long as the licensees operated under the license. It fixed royalties of $5 per day for each furnace, subject to a diminution of like amount for furnaces shut down for more than six consecutive working days. It fixed preferential discounts from the regular selling prices, confining them only to sales by the manufacturers to jobbers; and it was provided that no goods manufactured under the license should be sold unless they bore

a registered label (except where otherwise specified) owned by the licensee and in addition thereto a license tag or label approved by the licensor placed in a visible position thereon."

There were numerous stipulations in reference to the fixing of prices, and it was furthermore provided that 80 per cent of the royalties paid would be returned if the agreement should be complied with but forfeited if the provisions were violated in any particular. Moreover, there was a jobber's license agreement providing for certain discounts, resale prices and other restrictions, which bore the statement that it must be executed by the purchaser in order to purchase licensed sanitary enameled ware. In reference to the general statement of defendants' side of the case, the opinion goes on as follows:

"In this statement certain things are prominent. Before the agreements the manufacturers of enameled ware were independent and competitive. By the agreements they were combined, subjected themselves to certain rules and regulations, among others not to sell their product to the jobbers except at a price fixed not by trade and competitive conditions but by the decision of the committee of six of their number, and zones of sales were created; and the jobbers were brought into the combination and made its subjection complete and its purpose successful. Unless they entered the combination they could obtain no enameled ware from any manufacturer who was in the combination, and the condition of entry was not to resell to plumbers except at the prices determined by the manufacturers. The trade was, therefore, practically controlled from producer to consumer and the potency of the scheme was established by the co-operation of 85 per cent of the manufacturers, and their fidelity to it was secured not only by trade advantages but by what was practically a pecuniary penalty, not inaptly termed in the argument 'cash bail.' The royalty for each furnace was $5, 80 per cent of which was to be returned if the agreement was faithfully observed; it was to be 'forfeited as a penalty' if the agreement was violated. And for the faithful observance of their engagements the jobbers, too, were entitled to rebates from their purchases. It is testified that 90 per cent of the jobbers in number and more than 90 per cent in purchasing power joined the combination."

The most significant portions of the decision now follow and bring out the essential principles established in this case:

"The agreements clearly, therefore, transcended what was necessary to protect the use of the patent or the monopoly which the law conferred upon it. They passed to the purpose and accomplished a restraint of trade condemned by the Sherman law. It had, therefore, a purpose and accomplished a result not shown in the Bement case. There was a contention in that case that the contract of the National Harrow Company with Bement & Sons was part of a contract and combination with many other companies and constituted a violation of the Sherman law, but the fact was not established and the case was treated as one between the particular parties, the one granting and the other receiving a right to use a patented article with conditions suitable to protect such use and secure its benefits. And there is nothing in Henry versus A. B. Dick Company (224 U. S., 1) which contravenes the views herein expressed.

"The agreements in the case at bar combined the manufacturers and jobbers of enameled ware very much to the same purpose and results as the association of manufacturers and dealers in tiles combined them in Montague & Company versus Lowry (193 U. S., 38), which combination was condemned by this court as offending the Sherman law. The added element of the patent in the case at bar cannot confer immunity from a like condemnation, for the reasons we have stated. And this we say without entering into the consideration of the distinction of rights for which the government contends between a patented article and a patented tool used in the manufacture of an unpatented article. Rights conferred by patents are indeed very definite and extensive, but they do not give any more than other rights a universal license against positive prohibitions. The Sherman law is a limitation of rights, rights which may be pushed to evil consequences and therefore restrained.

"This court has had occasion in a number of cases to declare its principle. Two of those cases we have cited. The others it is not necessary to review or to quote from except to say that in the very latest of them the comprehensive and thorough character of the law is demonstrated and its sufficiency to prevent evasions of its policy 'by resort to any disguise or subterfuge of form,' or the escape of its prohibitions 'by any indirection.' (United States versus American Tobacco Company, 221 U. S., 106, 181.) Nor can they be evaded by good motives. The law is its own measure of right and wrong, of what it permits or forbids, and the judgment of the courts cannot be set up against it in a supposed accommodation of its policy with the good intention of parties, and, it may be, of some good results. (United States versus Freight Association, 166 U. S., 290; Armour Packing Company versus United States, 209 U. S., 56, 62.)"

In reference to the contentions advanced in behalf of the Colwell company, the opinion holds that it was a party to the general conspiracy, as follows:

"It is manifest that the Colwell company was a party to the combination and was also engaged in interstate commerce. The fact that its trade was less general than that of the other manufacturers and jobbers does not take from it the character of an interstate trader. The fact that it was restricted in less degree than the other jobbers, given a certain freedom of competition to meet local conditions in New York, diminishes only the degree of culpability but does not entirely remove it. Indeed, it may be said that such freedom does not even diminish culpability. It is a concession which may be made a means of crushing competition where it is most formidable."

The decree of the lower court, given in favor of the government, was upheld.

CHICAGO TELEPHONE COMPANY'S ANSWER TO THE BEMIS REPORT.

Responding to the arguments presented in the report of Mr. Edward W. Bemis on an investigation made at the request of the City Council of Chicago to assist in determining new telephone rates, the Chicago Telephone Company presented an answer to Mr. Bemis at a meeting of the Council committee on gas, oil and electric light on Nov. 21. Mr. B. E. Sunny, president of the company, read the company's answer, which was in the form of a printed pamphlet of thirty-one pages. The essential finding in the Bemis report was the conclusion that a reduction in telephone rates amounting to about $700,000 in the company's revenues is justified. In its answer the company undertakes to show that the alleged surplus of $700,000 pointed to by Mr. Bemis is purely fictitious and is the result of wholly unwarranted and inconsistent assumptions. The company goes on to say:

"These assumptions relate largely to the matter of depreciation, where the interests of the public and of the company are identical. The interest of the company in preserving its investment as nearly unimpaired as may be is no more direct than is the interest of the public in this same factor, from the standpoint of adequate facilities and unimpaired efficient service. A sufficient depreciation allowance is as essential to unimpaired service as it is to unimpaired investment. We believe that when the radical and manifest errors and omissions of the report of Professor Bemis are corrected its effect is simply to corrobo-

rate the conclusions of his predecessors and to sustain the contention of the company that the present rates are unreasonably low and that any revision of them should be not downward but upward."

The company criticised many of the findings of Mr. Bemis as erroneous and devoted much of its answer to the subject of depreciation. In his oral reply Mr. Bemis said, addressing the committee, that the essential differences between himself and the company related to only two or three points, the most important being the matter of depreciation. He contended that, inasmuch as the company has practically no competition, it would be fair to allow it only such a rate of return as would enable it to market its securities.

Mr. N. T. Guernsey, associate counsel of the American Telephone & Telegraph Company, addressed the committee briefly on behalf of the company. He pointed out that in its answer the company had made no allowance for going value, which he defined as the difference between the physical property without any revenue and the same property characterized by a developed business or a created income. It would seem to be self-evident, he said, that a property with a developed business is worth more than one without. This component is different from franchise value and it is not "good will." Going value, he said, is an inherent characteristic of physical property, but he admitted that it is difficult to measure such value.

OPPOSITION TO PROPOSED ILLINOIS PUBLIC SERVICE COMMISSION.

Hearings in relation to the proposed establishment of a public-service commission or commissions in the State of Illinois were held in Chicago last week by the Illinois Legislative Public Utilities Commission, which is the official name of the joint committee of the Illinois Legislature instructed to investigate the subject and report next January. State Senator John Dailey, of Peoria, is chairman of the legislative commission. The statement in our issue of Nov. 23, page 1087, that Senator Dailey was defeated for re-election on Nov. 5, is found to be in error, as the final canvass shows that he was returned by a plurality of forty-four votes.

In opening the public hearing in Chicago on Nov. 21 Senator Dailey explained the purposes of the commission. He remarked that all of the three principal political parties in Illinois have indorsed the idea of State regulation of public utilities by platform utterances. The commission has been at work intermittently since July, 1911. It has visited several other states, and Mr. Dailey remarked that the public-service commissions in states which have tried out the idea longest may be divided into three classes. The first is typified by the Wisconsin law, providing for one state-wide commission covering practically all forms of utilities. The second may be represented by the plan in New York, where there are two commissions with almost identical powers, but with geographical limitations, each commission covering a certain portion of the State. One commission takes care of the city of New York and the other of the remainder of the State. Mr. Dailey said that the great importance of the transportation question in New York City dictated this dual arrangement. A third plan may be typified by the arrangement in Massachusetts, where there are several commissions, each one devoted to certain classes of utilities, there being a railroad commission, a gas, water and electricity commission and a highway commission, the last named having jurisdiction over telephone and telegraph companies. In general, the Illinois legislators have found that the people of the various States where such commissions exist have a real respect for them, placing them on a par with courts of justice.

Senator Dailey analyzed the Wisconsin law and said that it appeared to be very satisfactory to the people. Something over a year ago, when the Illinois committee was in Madison, the Wisconsin commission had handled over 100 rate-making cases and there had not been a single appeal, although the law provides for an appeal to the courts. Speaking for himself personally, the chairman of the committee declared himself in favor of the enactment of a law providing for a public-service commission or commissions in the State of Illinois. He enumerated some of the advantages of the commission idea, such as the removal of public utilities from the domain of politics, doing away with feuds, making the securities of the companies stable, permitting the scientific investigation of rates, abolishing free or reduced-rate service and also abolishing discrimination between customers served under like conditions.

There was but little discussion at the hearing on the opening day. Mr. John T. McGrath, representing the Association of Stationary Engineers, favored the formation of a commission and urged the making of rates without discrimination. His association, he said, favored one state-wide commission, following the plan in Wisconsin. A public accountant spoke in favor of uniform accounting.

At the second public hearing on Nov. 22 Mr. William H. Sexton, corporation counsel of Chicago, was present to represent the Mayor of that city. Invitations had been extended to the principal public-utility companies of Chicago and the time was mostly taken up by an examination of Mr. L. G. Richardson, a lawyer representing the Chicago Telephone Company. Mr. Richardson appeared before the committee at a time when his company was under investigation by a committee of the Chicago City Council for the purpose of revising rates, and therefore he was rather guarded in what he had to say on the subject of state versus municipal regulation of public utilities. He said that the company had progressed very well under local control in Chicago, and he could see no great necessity for making a change. There is no reason, in his opinion, to suppose that a utility will not receive as good treatment from a committee of a city council as from any other body of men. The speaker declared that the creation of a state public-service commission is a serious proposition; if such a commission is recommended, the recommendation should embody protection of the utilities against competition as a cardinal feature.

Mr. Richardson's general position was not one in opposition to the proposal in a broad sense, but he was inclined to think that the creation of a state commission was hardly necessary. However, he was bound to admit that Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company, in a recent annual report, had conceded that public-service commissions have come to stay and had recognized their advantages. A number of questions were put to the speaker by Chairman Dailey and other members of the joint committee. Senator R. J. Barr spoke of the existence of two competing telephone companies in the city of Joliet and asked if the existence of a state commission would prevent such a situation. Mr. Richardson thought that it would and was also perfectly free to say that the Wisconsin law had worked very well. However, he pointed out the existence of a strong local feeling in many communities in reference to "home rule" in the control of local utilities. The attorney was asked if municipal control was not unfavorably affected by politics, and he answered by saying that after election the sobering effect of responsibility had a restraining effect on municipal officers. At another period in the discussion Mr. Richardson expressed himself as opposed to the theory of a state public service commission, but admitted that such a body might work out very well in practice and, in fact, had done so in Massachusetts and Wisconsin. He agreed with Senator Dailey that, speaking generally, the people of Wisconsin have as much confidence in the Railroad Commis-

sion of Wisconsin as they have in the Supreme Court of that State.

Several aldermen and other city officials attended the hearing of Nov. 23. All were emphatic in asserting their adherence to the principle of "home rule" in regulating utilities. Alderman E. F. Cullerton, the first speaker, doubted if the Illinois Legislature would pass a bill for state control. Unless the Legislature goes out of politics, the centralization of the control of public utilities would be a bad thing, he declared. The great moneyed interests own the public utility companies, and control of these enterprises should remain as close to the people as possible. There should be more checks on private combinations of capital than a state commission could promise. In answer to questions, the alderman said he thought a political campaign on the issue of 70-cent gas, such as has been witnessed in Chicago, was proper.

Alderman John A. Richert, chairman of the finance committee of the City Council, said that he believed all the aldermen favored the control of local utilities by local governments. He described the method of regulating utilities in Chicago by committees of the City Council. He was questioned closely on this point by Chairman Dailey, who appeared to think that the employment of two experts—Messrs. Hagenah and Bemis—in the local gas and telephone investigations, as the result of a change of administration, indicated a weakness in municipal control. Senator Dailey brought out the fact that the experts were not employed conjointly, but that one followed the other as the result, apparently, of a change in the political complexion of the City Council.

Alderman Eugene Block, chairman of the local transportation committee, declared that the experience of the city with the State Railroad and Warehouse Commission in the matter of track elevation in Chicago had not given it confidence in state commission control. He also asserted that political lines have been practically obliterated in Chicago in dealing with public-utility problems. Speaking of transportation, he said that the service given by the Chicago companies had been excellent on the whole, but that Chicago is growing rapidly and needs additional transportation facilities. But the local authorities can handle the situation better than a state commission could.

Alderman Mayer was vehement in his argument for "home rule." The idea of centralizing the control of public utilities in the hands of a few men is absolutely wrong, he said. A few men can be controlled by "interests" where a large body, like the seventy Chicago aldermen, cannot. This speaker could see benefit only to the public-service corporations, and not to the people of Chicago, by a state public-utility commission. In the course of his harangue he intimated that improper motives were back of the legislative commission's inquiry, but Senator Dailey, by gentle insistence, induced him to withdraw this charge.

NEW YORK EDISON COMPANY'S ANSWER TO RATE DISCRIMINATION CHARGE.

As may be recalled, notes have appeared in these columns from time to time referring to the hearings that have been going on since October, 1911, before Commissioner Maltbie, of the Public Service Commission for the First New York District, as a result of a petition that was filed with the commission early in the summer of 1911 by certain local organizations of stationary engineers, who alleged that the rates of the New York Edison Company discriminated unduly in favor of large users of energy and that the rates charged to retail users were excessive and not in proportion to the cost of production.

Shortly after the hearings were begun in this matter another petition embodying practically the same charges and signed by a number of retail customers of the company was filed with the commission by an isolated-plant publishing firm. After the complainant who presented the first petition had been heard, during hearings that extended over six or eight months, it was decided, as the reply of the New York Edison Company in both cases would be virtually the same, to let the complainants in the second case present their case before the lighting company gave its side of the matter.

Much time was given by the complainants during the hearings to examination of officials of the company upon the principles underlying the company's rate schedules, upon the cost of supplying service to various classes of customers, upon the company's revenue and upon its capitalization. After the complainants had introduced all of their evidence the company submitted a very lengthy reply, which was an admirable justification of central-station rates as a whole. A summary of this reply appeared in the *Electrical World* for Aug. 17, 1912. At the instance of the presiding commissioner the company subsequently filed further data amplifying its first statement to a considerable extent and also going into greater detail in regard to the growth in the number of its customers, the increases in its connected load, the cost of supplying service to all classes of consumers, together with the revenues received from the various sources.

Examination of Mr. John W. Lieb, Jr., third vice-president of the New York Edison Company, by counsel for the latter and by Commissioner Maltbie, brought forth a vast amount of data on central-station practice, which our limited space prevents us from reproducing as a whole. Some of it, however, as it appears below, may be of interest.

In the course of the examination the witness stated that the average 10-cent or retail customer, the customer who never uses in excess of 250 kw-hr. monthly, and is a member of the class which as a whole represents nearly 80 per cent of all the commercial customers on the company's books, is being served below the average cost for rendering this particular service and at a direct loss to the company. As a result of the rate reductions placed into effect by the company on July 1, 1911, there was a total decrease in revenue from all sources in the twelve months ended July 31, 1912, of approximately $1,250,000, of which $850,000, or about 70 per cent, was to the benefit of the small lighting customer. Investigation by the company showed that there was no appreciable stimulation in new business as a result of the new rates, which confirmed its past experience as to the futility of relying upon any considerable increase in new business and revenue over the usual natural growth to offset the direct loss of revenue attendant upon the introduction of lower rates.

Under the new schedule the average return has been reduced from 7.39 cents per kw-hr. to 6.87 cents per kw-hr., or approximately 7.03 per cent on all the regular commercial business of the company.

The average cost of serving all customers of the company per kilowatt-hour sold, based on the year 1910, is shown in Table I. These figures do not include any return on the company's investment, any fixed charge or allowance for profit.

In partial justification of the general policy of giving a lower rate per kilowatt-hour to the motor-service customers than to the retail lighting customers, the witness drew attention to the relative costs of supplying these classes of service. In the case of the New York Edison Company, he stated that the service connection for the smaller consumer represents an investment of over $65, or more than $542 per kilowatt, while a connection to a larger consumer represents a figure which decreases with increase in the size of the installation until, with an installation of 500 kw and over, the cost of service connections become insignificant and the burden of fixed charges on this feature of the investment is a minimum.

He also spoke of the wide diversity-factor found in industrial service, the improvements in the company's load-factor and the resultant improvement in the general economic conditions under which the company's service is furnished to all consumers at reduced prices as a result of supplying energy to the large consumer. He called attention to the longer average use which the large customer

TABLE I.—THE NEW YORK EDISON COMPANY; AVERAGE OPERATING COST OF SERVING ALL CLASSES OF CUSTOMERS.*

	Cents, per Kw-hr. Sold.
Production expenses	0.748
Transmission expenses	0.194
Electric storage expenses	0.007
Distribution expenses	0.594
Utilization expenses	0.284
Commercial expenses	0.275
General and miscellaneous expenses (exclusive of general amortization and taxes)	0.338
General amortization	0.826
Taxes	0.412
Total	3.678

*Exclusive of fixed charges, dividends, etc.

makes of his installation than does the ordinary retail consumer, and also to the more uniform use which the former makes of the service. The 597 customers of the company in its special wholesale class contribute 70 per cent as much revenue, he said, as that received from the 84,435 customers in the 10-cent class. That the general commercial principle of charging a less price for the larger quantity is generally recognized and approved was another point made by the company in justification of lower rates to the larger user of its energy.

Summarized, the defense of the practice, in addition to the foregoing, was that the wholesale customer is entitled to consideration in the making of a rate to fit his conditions of service, and to credit for the reduced cost of serving him, by reason of the proportionately less cost to him than to the small customer for plant equipment, general expenses such as management and clerical expenses, better credit, less accounting, less meter reading expenses, etc., smaller distribution expenses necessary in serving him and better inherent load-factor and larger output required, on which the cost of giving electric service so largely depends.

If the company did not have the large wholesale and motor-service customers which it is able to secure at the lower rates of its schedule, it was pointed out, its output would be enormously reduced and it would then become necessary to charge the smaller classes of customers a much higher rate than at present. It is absolutely necessary, the witness stated, to maintain reasonable and proper price differentials for various classes of customers under their various classes of service. The witness stated that the company's statistics indicate that the density of the distribution in the districts of wholesale supply is from twenty to thirty times as great as in the extended network supplying the smaller customers.

Concerning its automobile storage-battery and refrigeration rate, the company stated that this predicates a long-hour use of the installation much greater than that of the average customer under its general rates, and that the rate is still largely experimental and intended to develop business. Its application thus far has been chiefly in the charging of commercial electric vehicles. Coming as it does chiefly late at night and in the early morning hours, the charging is done with spare or lightly utilized generating equipment, the utilization of which serves the interests of the consumers as a whole, inasmuch as it improves the load-factor of the system. During the past twelve months only forty-six customers were served under this rate, with a total income of $80,624.

The matter of the rights of the company to supply energy at wholesale rates to a landlord for re-sale to his tenants, a matter upon which much time was spent by the complainants, was discussed at length by the witness, who pointed out that the owner or the lessee of a building controls the installation of service throughout and is at liberty to make such arrangements as he desires to supply his tenants with light and motor service. The rate at which he re-sells it is not within the jurisdiction of the company. Such matters as furnishing meters for each tenant to a landlord who makes a wholesale contract with the company and assumes all the obligations thereunder, including a guarantee that he will use only the service furnished by the company, were declared to be supported by sound commercial considerations.

A general statement of considerable length, made to show what "Edison service" stands for, discussed, among other things, the many bureaus which the company maintains for the convenience and benefit of its patrons and the services of which are furnished free of charge to them.

Another point to which considerable attention was given by the complainants centered upon the practice of the company in two instances of maintaining substations on the premises of its customers, in return for which a somewhat lower rate than that which would have been earned ordinarily is given. In one case, the company explained, the substation was installed when the demand of the customer in what at that time was a remote district made absolutely necessary a substation of some kind in close proximity to him, although the business then in sight did not warrant the construction of a special substation. A lease arrangement was therefore made under which from eight to ten times as much energy has been sent out into the general system as has been supplied to this individual customer.

A more recent substation, having a 7000-kw equipment, is located in a large department-store building in the heart of a very heavy demand for energy, and the fact that the company was able to obtain such facilities in this district, where real-estate values are at the highest point, makes them of great value to it. The output from this station to the system is already equal to that supplied to the building itself, and the outlook for further growth is excellent. Negotiations are now in progress, the company stated, through which the lease of the premises for substation pur-

TABLE II.—THE NEW YORK EDISON COMPANY; STATISTICS OF CONNECTED INSTALLATIONS, MANHATTAN AND BRONX.

Year.	Customers.	Meters Set.	Number of Incandescent Lamps.	Number of Arc Lamps.	Heating Appliances, Kw.	Storage Battery, etc., Kw.	Motors, hp.	50-Watt Equivalents.
Dec. 31, 1902	26,211	33,691	1,234,043	16,481	251	1,386	62,377	2,343,721
Dec. 31, 1903	31,749	40,230	1,481,638	19,975	339	1,880	78,683	2,851,463
Dec. 31, 1904	36,408	46,961	1,723,482	25,437	369	2,076	93,441	3,320,310
Dec. 31, 1905	43,630	56,572	2,058,060	27,627	428	2,324	109,371	3,878,666
Dec. 31, 1906	55,050	68,990	2,575,652	35,234	570	3,859	141,407	4,923,986
Dec. 31, 1907	65,323	80,809	3,057,294	40,679	921	4,669	169,588	5,856,166
Dec. 31, 1908	73,522	90,283	3,429,266	43,123	1,096	4,420	203,962	6,729,926
Dec. 31, 1909	84,995	104,449	3,813,889	40,985	1,230	5,486	224,391	7,422,649
Dec. 31, 1910	100,059	121,853	4,342,933	40,410	1,589	6,571	263,529	8,584,725
Dec. 31, 1911	119,971	144,018	4,912,428	39,329	2,283	9,024	309,187	9,922,562

poses will be entirely divorced from the present practice of deducting the rental from the price of energy delivered to the owner of the building.

Attention was also called by the company to the fact that the average consumption and income per meter and per customer is continually decreasing for all classes of customers. Average consumption has decreased from 213 kw-hr. for the year ended July 31, 1908, to 181 kw-hr. for the year ended July 31, 1912. This decrease is ascribed to several causes, of which the constant extension of the company's service to the more humble classes of residences and apartments, by virtue of the lower rates and the greater extent to which tungsten lamps are used, together with the reduced cost of these lamps, was probably the most important. The company's policy of doing everything possible to give to its customers the benefits of all improvements in lighting units was dwelt upon by the witness at length.

In substantiation of the above it was shown that tantalum lamps were first delivered to the customers of the New York Edison Company in the 40-watt size in October, 1906, at which time the price of these to customers entitled to free renewal of carbon lamps was 35 cents. The same type of lamp is furnished under schedules that went into effect April 1, 1912, at a charge to such customers of 17.5 cents each. Tungsten lamps were first supplied to consumers in May, 1908, the charge to customers entitled to free renewal of carbon lamps being $1 at that time for the 40-watt lamp. Under prices effective Nov. 1, 1912, this lamp is supplied at 26 cents. The 60-watt lamp in May, 1908, was supplied to the free renewal customers at $1.25. It is now supplied for 33 cents. The 100-watt lamp as originally supplied cost the customers $1.50. It is now furnished at 38 cents.

A series of tables and curves, showing the statistics of connected equivalents of all kinds since 1902, was introduced in evidence by the company. A summary of these tables appears in Table II

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION.

Chairman William R. Willcox of the Public Service Commission for the First District announced last week that conferences between the commission, the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company on the operating contracts for the dual system of rapid transit are drawing to a close, and that within a short time the commission will be able to advertise those contracts for public hearing. These are the contracts by which the companies mentioned will get an operating lease for forty-nine years upon the new subway and elevated lines in the dual system respectively allotted to them. This system will embrace more than 600 miles of single-track underground and elevated railroad and will cost about $350,000,000. Aside from the contracts the commission is pushing work on many of the details of this vast scheme of transportation. Construction work on Lexington Avenue, Manhattan, and in Brooklyn and the Bronx is going on to the extent of more than $70,000,000 already. Consents of property owners are being obtained on some of the new routes, and on others the commission has applied to the Appellate Division of the Supreme Court for a determination in lieu of such consents. The engineering department is rushing work on the plans as well as supervising the immense amount of construction work already going on. It is probable that the first part of the dual system will be placed in operation some time next year. This part will be the Fourth Avenue subway in Brooklyn from the Manhattan Bridge and its connection in Manhattan, the Centre Street loop subway, which connects the Williamsburgh and Manhattan Bridges, over which trains from the Fourth Avenue subway and the Brooklyn Rapid Transit elevated lines enter Manhattan. This part of the dual system will be operated by the New York Municipal Railway, a company organized by the Brooklyn Rapid Transit interests for the purpose. Eventually that company's elevated lines to Coney Island will be connected with and operated as a part of the Fourth Avenue subway.

MARYLAND COMMISSION.

The Maryland Public Service Commission has now heard all the arguments in the gas and electric rate investigation. Mr. Ritchie concluded the people's case after the attorneys for the Consolidated Gas, Electric Light & Power Company had summed up all of their arguments why the present rates should stand, and it was generally thought that the case would be submitted to the commission. But unexpected developments occurred later, when, by consent of the commission, Mr. James E. Aldred, president of the Consolidated Company, made an elaborate and extended statement of the position of his company. The burden of Mr. Aldred's argument was that the people of Baltimore, having through their representatives in the State Legislature and City Council authorized or tolerated the issue of all securities of the existing company and those companies now merged into it, should not escape responsibility to the investor who has purchased these securities. He insisted that the value of these securities should not be interfered with through the instrumentality of another agency of the people. Mr. Aldred, in discussing the wasteful and mistaken policy of competition, appeared to have reached a conclusion not unlike the people's contention. It is true that he transferred the final responsibility from the organizers of the companies to the Legislature that approved the consolidation, but in reference to the financial justification of the process he and Mr. Ritchie, the opposing counsel, seem to be in perfect accord. The commission will take the matter under advisement and the decision is not really expected until early in January.

WISCONSIN COMMISSION.

The Wisconsin Railroad Commission has rendered its decision on the petition of the Commercial Club of Superior for lower lighting rates. The investigation showed that the revenues of the Superior Water, Light & Power Company from its lighting service were high enough to justify a reduction in rates, and that, furthermore, the rates were inequitable and such as to tend to retard the development of at least certain parts of the business involved. The present primary rate of 10 cents net per kw-hr. for the first four hours' use per day of the connected load was objectionable because of the considerable use of energy to which the primary rate applies.

The evidence in the case centered primarily upon the rate of income and the amount of capital properly taken in computing the total return. The value of the electric plant, according to the company's books, was $620,900. The cost of reproduction, according to the commission's appraisal of June 30, 1911, was $395,096, and the present value $295,575. The company's total valuation included items of approximately $120,000 for discarded apparatus, $61,000 for discount on bonds, reorganization expenses and depreciation in land values. In addition to the book value the defendant claimed considerable amounts for going value and working capital. Due consideration was given to these contentions by the commission in arriving at a value to be used for rate-making purposes. In discussing the company's contention that all bond discounts on 6 per cent bonds should be included in the valuation, the commission pointed out that the question to be determined was whether the capital necessary for the construction of the plants could have been secured on any better terms. It was noted that the development work was carried on about the time of the panic in 1893 and that, while bonds have been sold to local investors at a higher price

than 80 during the boom period in Superior, it did not seem probable that a higher price could have been secured from outside investors in a practically untried enterprise with very little earning power. It was held that a part at least of the bond discounts should be included in the plant value, for "if business enterprises cannot secure capital on any better terms, then it necessarily follows that such bond discounts must represent a part of the cost of securing the capital." The commission, however, does not assume that all discounts should constitute a proper addition to physical value, inasmuch as this would discriminate in favor of the company with poor credit. The commission was of the opinion that the sum of $26,000 should be included in the value of the electric plant, which sum represents the estimated amount of discount over the prevailing rate of interest necessarily offered in the open market to secure funds for construction purposes.

While depreciation at the rate of 6.75 per cent on the reconstruction cost was provided for by the company for the year 1911, the commission held that a rate of 4.5 per cent was sufficient. An allowance of $11,500 for working capital was included in the valuation, as was also an allowance of $55,000 for going value. In its consideration of the question of going value the commission noted that the investment in the physical property of the defendant company was greater at various periods than the immediate business of the company required and that upon the collapse of the boom in Superior the company found itself encumbered with plants considerably larger than necessary to supply the needs of all users. "Going costs incurred during periods of depression become a burden upon succeeding years until the natural condition of business growth may again exist and the company is able to recoup itself for early losses. It is not clear, however, that such losses due to lack of growth or retrogression of community development should be charged in their entirety against the consumers, even though the sacrifices of the owners have been prudently made."

The depreciation which has taken place in real estate value since the purchase during the boom period was taken into consideration in determining the total valuation. By including all items a total valuation of approximately $480,000 was arrived at, and it appeared that the net earnings were sufficient to yield a reasonable return on this amount and to allow for some reduction in rates. It was pointed out that a determination of the value of the electric plant for rate-making purposes at this time was complicated by the fact that the plant had reached its economical capacity and that extensions and additions must be made in the near future. The investment in an adequate plant must be taken into consideration, but the commission did not consider it advisable to make present consumers bear the entire burden of these future additions, beyond a slight increase in the unit costs.

By allowing an 8 per cent rate of return the following unit costs were arrived at: For one hour's daily use of the active connected load, 12.38 cents; for two hours' use, 7.67 cents; for three hours' use, 6.10 cents; for five hours' use, 4.85 cents; for ten hours', 3.91 cents. Upon this basis the following rate schedule for incandescent lighting was ordered: Primary rate, 10 cents net per kw-hr. for energy used equivalent to or less than the first forty hours' use per month of the active connected load; secondary rate, 7.5 cents net per kw-hr. for additional energy used equivalent to or less than the next sixty hours' use; excess rate, 5 cents net for energy in excess of 100 hours' use per month of the active connected load. For all signs and outside decorative lighting a charge of 6 cents net on a yearly contract basis will be made. For window, showcase and basement salesroom lighting there is to be a charge of 7 cents net, and for energy utilized for heating or cooking purposes, 5 cents net.

In Class A, consisting of residences, flats and private rooming houses, the active connected load is to be taken as 60 per cent of the connected load up to 500 watts and 33.3 per cent of the connected load in excess of 500 watts. In Class B, consisting of banks, offices, business and professional establishments, public halls, depots, etc., the active connected load is to be taken as 70 per cent of the connected load when the total connected load is equal to or less than 2.5 kw. If the installation exceeds 2.5 kw nominal rated capacity, 55 per cent of such a part of the connected load over and above 2.5 kw is to be taken as active. In Class C, consisting of federal, state and county buildings, churches, hotels, small factories, etc., 55 per cent of the connected load is to be taken as active. In Class D, consisting of sign and window lighting on a yearly contract basis, 100 per cent is to be regarded as active. The minimum bill for general commercial and residence lighting is to consist of a charge of 5 cents per 50-watt unit per month. The minimum bill for heating and cooking is to be $1 net per kw installed.

No change was ordered in either the motor service or arc-lighting rates, although it developed that the cost of supplying the latter was greater than the revenues received. The company is contemplating the substitution of tungsten lamps for the present 7.5-amp inclosed alternating-current arc lamps, and the commission, therefore, did not think it advisable to make any recommendations at the present time.

CALIFORNIA COMMISSION

The Railroad Commission has ordered a reduction from 30 cents to 25 cents in the telephone rates between San Francisco and Hayward, and Oakland and the towns of Mill Valley, Palo Alto, Redwood City, San Mateo and San Rafael.

The commission has rendered a decision granting permission to the Southern California Utilities Company to issue $10,000,000 of bonds. The proceeds of these bonds will be used for the development of an extensive land and irrigation system embracing 30,000 acres in Riverside County.

Current News and Notes

ELECTRICAL ENERGY FOR SAN DIEGO EXPOSITION.—An arrangement has been made by which the San Diego (Cal.) Consolidated Gas & Electric Company will supply electrical energy for building operations during the construction of the Panama-California Exposition structures. Construction will extend, probably, over a period of three years, and it is expected that additional motors will be added as needed. The initial contract is for motors rated at 142 hp to be used to operate concrete mixers, woodworking machinery and the like.

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N. E. L. A. RATE RESEARCH COMMITTEE DISCUSSES FORMS FOR FILING SCHEDULES.—A well-attended meeting of the rate research committee of the National Electric Light Association was held in Chicago on Nov. 19 and 20. Chairman E. W. Lloyd presided, and the other members present were Messrs. S. E. Doane, R. S. Hale, Frank W. Smith, W. K. Winslow, R. A. Philip and J. D. Lyon. Mr. William J. Norton, secretary of the committee, also attended the meetings, which were held at his office, the committee having its headquarters this year in Chicago. President Frank M. Tait of the N. E. L. A. and Past-president John F. Gilchrist attended some of the sessions. The committee devoted considerable time to a discussion of the complex subject of drafting forms for the filing of company schedules, and it made progress in covering all the important phases of this branch of its work. The next meeting will be held in Cleveland on Jan. 9 and 10.

All-Night Lighting for Minot, N. D.—The city of Minot, N. D., has entered into a new contract with the Consumers' Power Company providing for all-night and every-night service in place of the former schedule based on moonlight.

* * *

Demonstration of the Pulmotor.—At the annual meeting of the Westchester County Medical Society recently held at White Plains, N. Y., a demonstration was made of the pulmotor which the Westchester Lighting Company has purchased for use in resuscitating victims from electric shock. Much interest was shown by the medical men present.

* * *

Chicago February Motor-Vehicle Show.—The annual Chicago exhibit of commercial motor vehicles will be held in the Coliseum and First Regiment Armory from Feb. 10 to 15, 1913. Sixty-five manufacturers have contracted for space, and both electric and gasoline wagons will be shown. The number of exhibitors showing motor vehicles of both types will be larger than ever before, it is thought.

* * *

Suburban Extensions Near Minneapolis.—The Minneapolis General Electric Company has closed a ten-year contract for the sale of electrical energy to the Northern Power Company, which operates in the villages of Excelsior, Deephaven, Tonka Bay, Wazata and a number of other communities on the shore of Lake Minnetonka near Minneapolis. In this area there is at present a summer population of about 12,000 and a winter population of about 5000. To serve it a 9-mile continuation of the transmission line now being extended to Hopkins, Minn., will be necessary. The Northern Power Company, which is rapidly extending its lines to all of the summer resorts around the lake, will shut down its steam generating station at Excelsior.

* * *

Water-Power Development in Connection with Canal Systems.—The New York State Commission on Barge Canal Operation, which has recently returned from an inspection of a portion of the Canadian canal system, reports the general feasibility of water-power development as one of the by-products in canal construction and operation. The commission has pointed out that the Dominion government in connection with canalization has disposed of the accompanying hydraulic rights by lease, and coincident with the canal construction there is going forward the creation of forebays and the construction of power houses for the development of several thousand horse-power. Private capital is doing all the development work, outside of the canals, locks and dams, under twenty-one-year leases, with renewal clauses for an additional period of forty-two years.

* * *

The Winds of the United States.—The climatologist of the United States Weather Bureau, Mr. P. C. Day, has prepared an interesting contribution to the 1911 year book of the Department of Agriculture, entitled "The Winds of the United States and Their Economic Uses." Mr. Day's monograph has now been published as a separate pamphlet. It discusses changes in velocity due to elevation, hourly velocities, high winds on the middle Pacific Coast, winds in mountain regions, the daily march of the wind, extreme velocities, the economic use of wind and localities favorable for the successful use of windmills. The bulletin states that one of the most promising fields for the future successful development of power from the use of the windmill lies in the possibilities of successfully generating and storing electrical energy, which may be used later for the heating and lighting of country or suburban homes, charging electric motor cars, working agricultural machinery, cooking, irrigation pumping, etc. Electric turbines of this character are now in successful operation in England and evidently a wide field of usefulness is open to them in this country.

* * *

Basis of Rate Making.—The National Civic Federation has recently distributed advance sheets of that portion of its compilation and analysis of public-utility regulation laws of the United States relating to the specific question of rate making. This is one of the fifteen parts of the complete compilation and is printed for and distributed to interested persons, subject to subsequent additions, deductions and alterations. The analysis is subdivided under four headings, as follows: (a) general requirements as to reasonableness of rates; (b) elements to be considered as a basis for reasonable rates; (c) valuation of the property of utilities; (d) sliding scale, profit sharing, automatic adjustment, minimum charge and graduated charges. Mr. John H. Gray, 1 Madison Avenue, New York, is director of investigation.

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The I. E. S. Illumination Primer.—"Light: Its Use and Misuse," a primer on light and illumination which has been published by the Illuminating Engineering Society, as noted previously in these columns, has already gone into a second edition. Written in a clear and comprehensive manner for popular reading, this little pamphlet has met with immediate favor. It has occasioned considerable complimentary criticism from people who are generally supposed to have little or no interest in the subject of lighting. From the heads of engineering and physics departments of schools and colleges the society has received numerous letters of commendation, together with requests for quantities of the primer for distribution to students. Architects, engineers, oculists, merchants and others have also expressed their appreciation of the publication. Several lighting companies are planning to issue it to their customers. One large manufacturing company in London has cabled for permission to print and distribute a large edition in Europe. It is not unlikely that many additional editions will be printed.

* * *

Depreciation of Public Service Properties.—Under the title "Should Public Service Properties Be Depreciated to Obtain Fair Value in Rate or Regulation Cases?" Mr. James E. Allison, commissioner and chief engineer of the St. Louis Public Service Commission, presented an interesting report to the commission under date of Sept. 11, 1912. Mr. Allison submitted elaborate arguments in support of the proposition that a depreciation reserve fund is unnecessary and that it is consequently improper to deduct depreciation from reproduction cost in arriving at the fair present value. Among the conclusions presented at the end of the report are the following: "A review of this report would show that in dealing with a property giving good service the just amount to be earned on should include the cost of gross value of the property efficiently serving the public at the time of the valuation, unless it may be shown that the public has reimbursed the owners of the property for the amount of the proposed depreciation. In most valuations of public utilities we are dealing with a situation where there has been in the past no regulation of rates based upon a reasonable return and where there has been no legal requirement of a depreciation fund. . . . In the case of a heretofore unregulated property it cannot be shown that the company should have set aside depreciation charges to accumulate a fund equal to the theoretical depreciation, for such a fund would be needless. . . . The conclusion seems clear, then, that in all cases of heretofore unregulated properties we cannot justly depreciate to obtain fair value unless we admit the justice of *ex post facto* laws or equivalent regulation, or unless we interpret fair value to mean market value and not just amount."

WORK OF THE COMMERCIAL SECTION, N. E. L. A.—A meeting of the executive committee of the Commercial Section of the National Electric Light Association will be held in Chicago on Dec. 9. Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, 120 West Adams Street, Chicago, is chairman of the section. Plans will be discussed for the work, which will be reported at the Chicago convention of the association June, 1913.

* * *

HUGE NORWEGIAN HYDROELECTRIC PROJECT.—It is reported that financiers have asked permission of the Norwegian government to harness the Aura and Lilledal Rivers, east of Molde, in the Romsdalen district, Norway. The scheme involves the erection of a dam 140 ft. high and the transmission of water through a tunnel to Sundalen, where 200,000 hp could be developed. The estimated cost of the project is $10,000,000 and the scheme if carried out will result in one of the largest hydroelectric power plants in the world.

* * *

REPORT ON SAN FRANCISCO TRACTION FRANCHISES.—Mr. Bion J. Arnold, consulting engineer, has submitted to the San Francisco Board of Supervisors his preliminary report No. 13, dealing generally with present transportation conditions in that city and specifically with legal and franchise matters and charter amendments in connection therewith. An appendix to the report contains a résumé of the present charter provisions, discussions thereof and proposed amendments, a letter transmitting a charter amendment recommended by a sub-committee consisting of Messrs. Delos F. Wilcox, E. A. Walcott and Bion J. Arnold, a synopsis of the amendments by Mr. Wilcox, and the text of the charter amendment as adopted.

* * *

CONSERVATION.—In a recent number of the bi-monthly bulletin of the Indiana State Library, issue No. 5 of Vol. 7, under date of September, there is published a list of selected books and papers on the subject of conservation and natural resources. The bulletin bears the title "A Guide to the Study of Conservation." The field of conservation is divided under the following headings: Lands, waters, forests, minerals, vital resources, and general. A list of the more important organizations devoted to conservation is also contained in the bulletin, together with references to magazine literature and the publications of the federal government. Mr. D. C. Brown is the librarian and secretary of the Indiana State Library Board, Indianapolis, Ind.

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N. E. L. A. CONVENTION TRIP COMPETITION.—Last season the Brooklyn Company Section of the National Electric Light Association held a competition the winners of which were sent to the Seattle convention at the company's expense. A similar competition is now under way, the winner to have a free trip to the Chicago convention in June. The competition is open to all members of the Brooklyn Company Section, excepting members of the staff council and the winners of the 1912 competition. Each competitor is to be rated on the following basis: For writing a paper which shall be accepted for presentation before the section at a regular meeting, such a number of points as the merits of the paper shall warrant, in no case to exceed 100 points. An additional five points will be given to competitors who submit acceptable papers before Dec. 1, 1912. Ten points, according to the merits of the discussion, will be given for taking part in the discussion of papers presented at any regular meeting. One point is given for each meeting attended by the contestant during the session.

* * *

COMMISSIONER ESHLEMAN ON PUBLIC UTILITY REGULATION.—Chairman John M. Eshleman of the California Railroad Commission addressed the members of the Boston City Club on Nov. 21, his subject being "Control of Public Service Corporations by a Single Commission." Mr. Eshleman described the conditions in California under the old régime and related the course of the movement which resulted in the creation of the Public Utility Commission. The three subjects of regulation, he said, are rates, service and securities, and all of these should be regulated regardless of the character of the utility. Divided authority between city and state as to utilities operating within and without cities means duplication of work as many times over as the authority is divided. It is obviously wasteful, he declared, to employ a number of agencies to accomplish that which could be better done by one. Mr. Eshleman also referred to the need which all public service commissions have of expert assistance and advice. Prof. Bruce Wyman, of Harvard University, also spoke earnestly on the necessity of having in Massachusetts a commission with powers like those of the California Commission instead of the present divided commissions with limited powers. Massachusetts now has four commissions, the consolidation of which has been proposed.

* * *

ACTIVITIES OF THE NEW YORK COMPANIES' SECTION, N. E. L. A.—The New York Edison Company has extended an invitation to all Class B members of the New York Companies' Section to enrol in its commercial educational courses. These are conducted by a special corps under the direction of the Educational Bureau, and lectures are given each week by various experts of national repute, written examinations being held after each lecture. The topic for discussion at the December meeting of New York Companies' Section will be "Meters." At the meeting to be held on Jan. 20 Mr. Frank M. Tait, president of the National Electric Light Association, will address the section, which, it is claimed, has the distinction of being the largest company section. It has been decided to provide free transportation for three members to the next convention of the N. E. L. A. at Chicago, and a committee has been appointed to supervise the arrangements for a convention trip contest. Prizes are being offered each month by the publication committee of the section for the best three original cartoons drawn by Class B members, the cartoons to be published in the company section bulletin.

* * *

SOCIETY MEETINGS.

ANNUAL MEETING OF THE CEDARMEN.—The Northwestern Cedarmen's Association will hold its annual meeting at Duluth, Minn., on Jan. 7 and 8. Mr. H. H. McKinney, 743 Lumber Exchange, Minneapolis, Minn., is secretary of the association.

* * *

TEXAS A. AND M. COLLEGE BRANCH, A. I. E. E.—At a recent meeting of the Texas Agricultural and Mechanical College Branch, A. I. E. E., College Station, Tex., Mr. S. E. Bowler, of Fort Worth, was chosen chairman and Mr. E. S. Lammers, Dallas, was made secretary. Topics for the coming sessions of the year have been announced as follows: Nov. 15, "Electricity as Applied to the Farm," by Mr. P. W. Walker; "Central-Station Design," by Mr. M. L. Anderson. Dec. 2, "Comparison of Aluminum and Mercury-Arc Rectifiers," by Mr. H. C. von Roseberg; "Unity Power-Factor Motor," by Prof. J. E. Lear. Dec. 13, "Engineering Experiment Station Work at the University of Illinois," by Mr. O. B. Wooten; "Gas-Electric Plant in a Cement Mill," by Mr. J. F. Brown. Jan. 10, "Steam-Turbine Development," by Mr. A. J. Neff; "Spherical Photometry," by Mr. R. W. Nolte. Jan. 24, "Efficiency Engineering," by Mr. J. H. Proctor; "The Agricultural and Mechanical Central Station," by Mr. D. H. Levy.

Annual Meeting of the Executive Committee, Iowa Electrical Association.—The annual meeting of the executive committee of the Iowa Electrical Association was held at the Hotel Keokuk, Keokuk, Ia., on Nov. 15. Mr. W. H. Thompson, of Davenport, was elected president of the committee and Mr. H. B. Maynor, of Waterloo, vice-president.

* * *

Birmingham Association of Electrical Engineers.—At the November meeting of the Birmingham Association of Electrical Engineers the following officers were elected for the ensuing year: President, Mr. F. V. Underwood; vice-president, Mr. D. J. Gaboury; secretary-treasurer, Mr. W. H. Fleming. Mr. Underwood, the newly elected president, is superintendent of the electric-lighting department of the Birmingham Railway, Light & Power Company. Mr. Gaboury is electrical engineer for the Woodward Iron Company. The Birmingham association has enjoyed a gratifying growth during the past year and numbers among its members many of the leading electrical engineers of the South.

* * *

Baltimore Section, A. I. E. E.—The Baltimore Section of the American Institute of Electrical Engineers met on the evening of Nov. 22 in the Physical Laboratory of Johns Hopkins University, and the following papers dealing with telephone topics were presented: "Toll Line Traffic," by Mr. L. McC. Clarke, traffic engineer; "Outside Construction," by Mr. L. F. Cromwell, district plant engineer; "Telephone Transmission," by Mr. H. B. Stabler, equipment engineer, and "Electrolysis," by Mr. F. T. Iddings, chief cable tester. All of the authors were connected with the Chesapeake & Potomac Telephone Company. After all of the papers had been read a general discussion ensued. At the December meeting of the section a dinner will be held.

* * *

New Officers for Iowa Electrical Association.—A meeting of the executive committee of the Iowa Electrical Association was held in Keokuk, Ia., on Nov. 15, at which Mr. W. H. Thomson, Jr., manager of the Des Moines Electric Company, was elected president to fill the vacancy occasioned by the resignation of Mr. Paul B. Sawyer, formerly of Dubuque, and Mr. H. B. Maynard, secretary of the Citizens' Gas & Electric Company, Waterloo, Ia., was chosen as secretary to succeed Mr. A. W. Zahm, whose acceptance of the position of manager of the Minneapolis Electric Equipment Company, Minneapolis, Minn., was noted in our personal columns in the issue of Nov. 16. Following the transaction of regular business, the members of the committee were guests of the Mississippi River Power Company, the Stone-Webster Company and the Hydraulic Engineering Company of Maine, visiting the power house and dam which are now nearing completion.

* * *

Baltimore N. E. L. A.—About 700 members of the electrical division of the Consolidated Gas, Electric Light & Power Company of Baltimore recently had a social rally in the Industrial Building, Greenmount Avenue and Preston Street, when the company acted as host, the aim being to bring its busy army of workers into closer social intercourse. Brief talks were made by Mr. Herbert A. Wagner, vice-president of the company and head of the electrical division; Mr. Douglass Burnett, manager of the commercial department, and Mr. E. D. Edmonston, general superintendent. Vice-president Wagner gave a thrill of delight to his audience by making the announcement that the company would send five of its employees, selected from the ranks, to the annual meeting of the National Electric Light Association to be held in Chicago next July. The men are to be chosen on merit in the progress made in their work in the interim. The company will defray all expenses of the trip.

New York Electrical Society.—At the 314th meeting of the New York Electrical Society, which was held in the Engineering Societies Building on Nov. 25, Mr. Horatio A. Foster gave an interesting talk on the "Reminiscences of an Electrical Engineer." In the audience were several of the pioneers in the electrical field, and Mr. Foster's address was supplemented by remarks from Messrs. T. C. Martin, William J. Hammer, Elias E. Ries and C. O. Mailloux. The secretary announced that the society has received from the New York Central Railroad an invitation to make a visit of inspection on Dec. 19 to the new terminal buildings of the company, which are shortly to be opened to the public. He also referred to a lecture, the date of which will be announced later, by Mr. Elmer A. Sperry on the application of the gyroscope to the flying machine.

* * *

American Railway Association at Chicago.—At the fall meeting of the American Railway Association held at the Blackstone Hotel, Chicago, on Nov. 20 the committee on electrical working, of which Mr. George Gibbs, chief engineer of electric traction of the Long Island Railroad, is chairman, presented a very short report. The committee stated that it had held no formal sessions during the last summer. Practically no comments have been received by the committee in relation to its report submitted last summer and covering third-rail clearances and specifications for overhead crossings of electric wires. The committee is now giving attention to the question of the location of overhead working conductors which are required for alternating-current traction systems. It hopes to be able to submit a report on this subject at the meeting of the association next spring. The New York Central & Hudson River Railroad Company, the New York, New Haven & Hartford Railroad Company and the Southern Pacific Company were elected members of the committee on electrical working. About 180 member companies were represented at the meeting of the association by about 200 delegates. The executive committee reported that the membership of the association now comprises 349 companies operating 264,000 miles of railroad. The next meeting of the association will be held in New York City on May 21, 1913.

* * *

Annual Meeting of the Alabama Light & Traction Association.—At the annual meeting of the Alabama Light & Traction Association, held at Birmingham, Ala., on Nov. 14 and 15 in the auditorium of the Chamber of Commerce, the following papers were presented: "Street Lighting," by Mr. A. M. Klingman, of the National Electric Lamp Association; "Residence and Store Lighting," by Mr. J. C. Henniger, of the National Electric Lamp Association; "Street Railway Matters and the Double-Deck Cars," by Mr. L. D. Mathes, of the Montgomery Traction Company; "Retort House Practice," by Mr. C. W. Wallace, of the Montgomery Light & Water Power Company; "The Small Tenement Consumer," by Mr. A. F. Kersting, of the Mobile Gas Company; "Accounting Matters," by Mr. V. B. Day, of the Montgomery Light & Water Power Company; "Rate Research," by Mr. M. W. Offutt, of the Alabama Power Company; "Association Work in the South," by Mr. B. H. Braymer, Atlanta, Ga.; "Increasing the Day Load," by Mr. F. V. Underwood, of the Birmingham Railway, Light & Power Company. After the transaction of general business at the final session the election of officers took place, the following officers for the ensuing year being elected: President, Mr. C. C. Henderson, president and manager of the Henderson Light & Power Company, Greenville, Ala.; vice-president, Mr. R. O. Ellis, Selma; secretary and treasurer, Mr. H. O. Hanson, Mobile. The newly elected executive committee consists of Mr. A. H. Ford, Birmingham; Mr. T. K. Jackson, Mobile; Mr. C. E. White, Montgomery; Mr. A. H. Sparks, Jasper, and Mr. R. C. Rands, Anniston.

HYDROELECTRIC ENERGY FOR COAL FIELDS.

Plants Nos. 2 and 4, Comprising Initial 29,000-hp Installation of the Appalachian Power Company on the New River.

Plans for Group of Hydroelectric Stations with Common Step-Up Transformer House—88,000-Volt Transmission Lines with "Wishbone" Cross-Arms and Suspension Insulators.

OF the five water-power sites, aggregating 225-ft. drop and 75,000 hp, which the Appalachian Power Company has planned to develop on the New River in Virginia, two plants, totaling 29,000 hp, are now completed and in operation, developing hydroelectric energy for transmission throughout the surrounding rich mineral and agricultural country. The developments first finished are known as No. 2 and No. 4 respectively, and from them as a nucleus 88,000-volt lines have been built to Bluefield and Coalwood, W. Va., and to Saltville and Roanoke, Va.

Of special interest in this lay-out is the provision of a common transformer house which receives the 13,000-volt, 60-cycle output of the several water-power plants, regulating the energy developed, and stepping it up to 88,000 volts for transmission. Four of the five sites are located within a distance of 5 miles, and arrangements have been made for extending the transformer station to house additional equipment as the rest of the plants are built.

DEVELOPMENT AT MOUNTAIN ISLAND.

Site No. 4 was the first plant to be completed. The development here utilizes Mountain Island in the New River, a spillway dam 1000 ft. long having been built across the main channel of the stream at the head of the island. In this way the narrower channel on the north side of the island has become a natural headrace leading to the retaining dam and power house which close the north channel at the foot of the island proper.

From the plant a tailrace has been excavated for a distance of 1800 ft. down stream, adding 15 ft. of head and making the total fall available at the turbines 38 ft. To excavate this tailrace required the removal of 66,000 cu. yd. of rock. The spillway dam is of the solid-concrete, gravity-section type, keyed into and seated upon the solid rock of the river bottom. In average section the spillway crest is approximately 17 ft. high, to which can be added 5 ft. of flashboards. From the principal concrete mass there project thirty concrete piers at 32-ft. intervals, carrying the flashboard bridge at a height 12 ft. above the sill and well out of the way of any possible high water. The spillway dam is provided with a base 26 ft. wide, and its upper flow surface is arranged with a double curve to discharge the overflow, which descends to the level of the lower rapids.

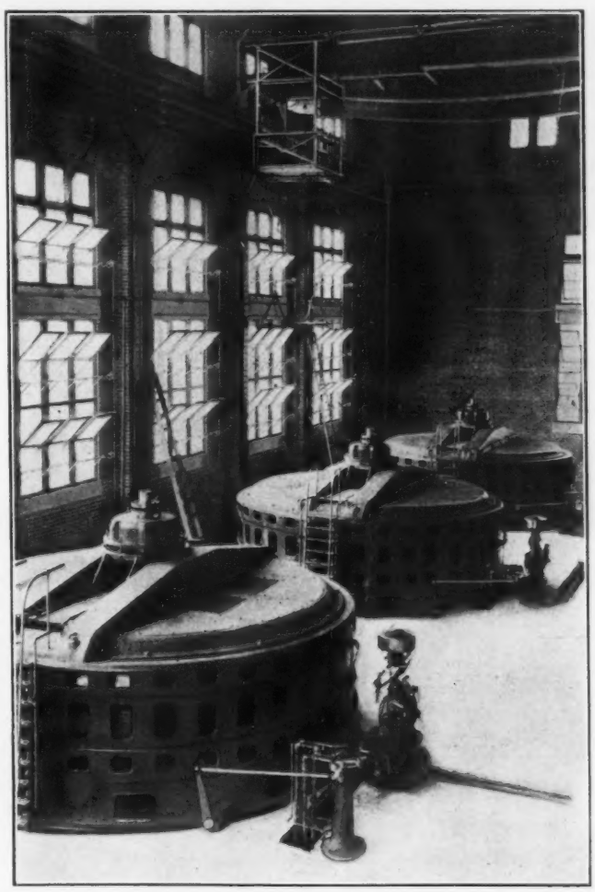


Fig. 1—Interior of Power House.

Concrete has also been used for the foundations and bulkhead walls of the power house, the superstructure being of steel and brick. The building measures 132 ft. by 61 ft. in plan section and provides for three main 3000-hp units and two exciter sets, all of which have been installed. The waterwheels are of the vertical-shaft, single-runner Francis type and were built by the I. P. Morris Company, Philadelphia. They run at 97 r.p.m. and drive General Electric 13,200-volt, 60-cycle, three-phase alternators. Each turbine has its own 13-ft. by 21-ft. inlet passage, leading from the tracks and headgates, molded in the solid concrete. The exciters are supplied from a common inlet chamber which is equipped with branch penstock tubes.

NEW RIVER PLANT NO. 2.

A mile and a half from the No. 4 development above referred to is the No. 2 site, the second plant to be completed of the initial development. This station utilizes a hydraulic head of nearly 50 ft. and contains four 5000-kw waterwheel sets. Its solid concrete dam backs up the water to the tailrace level of the first-mentioned development, a distance of almost 3 miles measured along the bed of the stream, which here swings in a broad bend to the south. The incident rise in level of the stream surface caused by the No. 2 dam has necessitated the relocation of nearly 4 miles of the original grade of the Norfolk & Western Railroad's North Carolina branch.

At the second site the power-house bulkhead wall forms a part of the main dam, which thus has an overall length of nearly 750 ft. The spillway section, 530 ft. long, has a height of 50 ft., measured from its sill to the footing on the bedrock. The gravity section of the structure has a base 56 ft. long and is designed with a 2.5 per cent factor of safety against overturning. At intervals of 30 ft. piers extend 15 ft. above the spillway level, carrying the foot-bridge for operating the Tainter gates and flashboards. Six of these spans are provided with Tainter gates and the other nine are arranged for flashboards.

Above and at the side of the power house an auxiliary spillway has been built by cutting through a ridge to a natural sluice or gulley paralleling the main stream. Additional spillway length of nearly 200 ft. is secured in this

way, providing for six clear 31-ft. spans of flashboards, similar to the arrangement used on the main dam.

The power-house measures in plan 170 ft. by 50 ft., not including the concrete foundations and bulkhead containing the headgates and trash-racks. The superstructure of the station building is of steel and brick. It contains four 5000-hp single-runner Francis type waterwheels, built by the Morris company, each driving a 13,200-volt, 60-cycle, three-phase General Electric generator at 116 r.p.m. The concrete draft tubes molded as a part of the foundations discharge into the 90-ft. tailrace excavated from the solid rock. Sixteen thousand cubic yards of concrete were used in the plant foundations alone, and 33,000 cu. yd. were required for the spillway. With the reservoir regulation obtainable by means of the Tainter gates, it is possible to store and conserve the flow of the river for any reasonable daily load-factor. Midway between the two pairs of 5000-hp main units there have been installed a pair of turbine-driven exciter sets. These exciter sets are fed by means of a separate penstock.

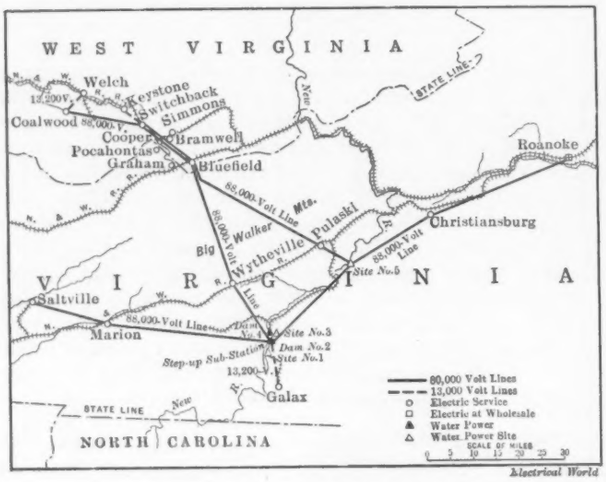


Fig. 2—Map of Present 88,000-Volt and 13,200-Volt Lines.

STEP-UP TRANSFORMER SUBSTATION.

Near the No. 2 site just described is located the step-up transformer substation, whose position is thus nearly midway of the 13,200-volt lines, connecting it with the future four generating stations, two of which are already operating. The electrical control equipment of these plants, it will be noted, is restricted to that associated with the generators and 13,200-volt buses, all of the high-tension and transforming apparatus being installed in the step-up station just referred to.

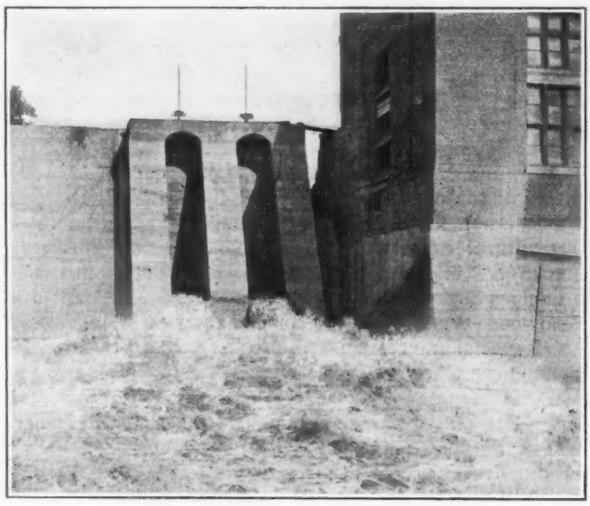


Fig. 4—Sluice Gates.

The present equipment comprises four 6000-kw water-cooled three-phase General Electric transformers, with 13,200-volt primaries and 88,000-volt secondaries. Aluminum-cell lightning arresters, with outdoor horn-gaps mounted on the roof, protect the 88,000-volt entries. Vertical roof-type insulators admit the arrester taps, the cells themselves being located in a separate gallery above the switch room. The main line conductors are carried on over the station roof on strain insulators and drop down on the far side to

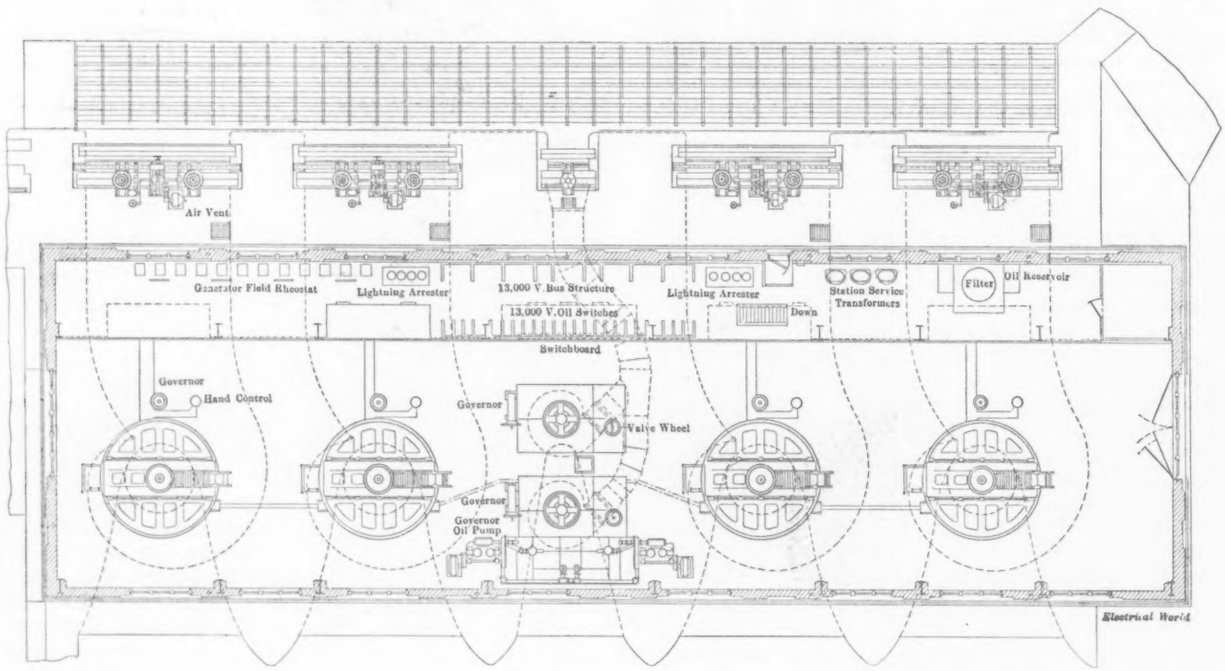


Fig. 3—Plan of Power House No. 2.

wall entries, connecting through choke coils to the Kilo oil switches. Provision is made for two three-phase circuits. Similar oil switches connect the transformer secondaries to the substation buses, which are carried overhead in the switch room. Below the second-story switch room are the transformer compartments and in a corridor are the 13,200-volt switching apparatus, aluminum-cell arresters, etc.

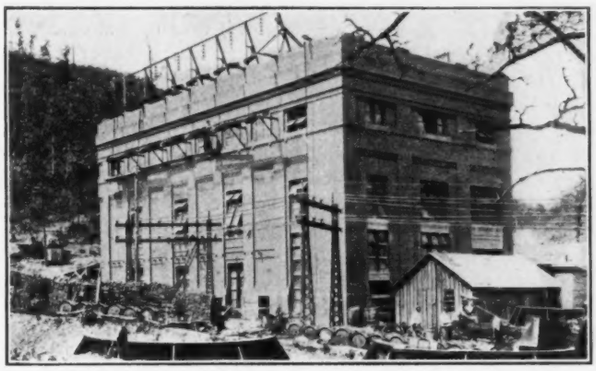


Fig. 5—Exterior of Transformer House.

88,000-VOLT TRANSMISSION LINES.

From the step-up substation there radiate nearly 200 miles of 88,000-volt, three-phase circuits. The familiar Byllesby "wishbone" type of cross-arm construction has been used throughout on these lines, although with several modifications from the form first adopted several years ago. Instead of steel angles, 6-in. by 4-in. oak timbers are used for arms, being pinned to the pole by through-bolts at their center points. The original construction, it will be recalled, employed a two-thirds spacing of the pins. The bolts for these cross-arms also hold in place the 3-in. by 3-in. by 3/16-in. steel-angle bayonet, 7 ft. long, which supports the ground cable 2 ft. above the pole top. This steel bayonet is earthed by a ground wire running down the pole and ending in a coil buried at the butt. Forty-five-foot poles have been adopted as standard. Nineteen feet below the pole peak and 8 ft. below the lowest line conductor a pair of telephone wires are carried on pole brackets. Four-disk suspension insulators are used, the distance between conductors on the

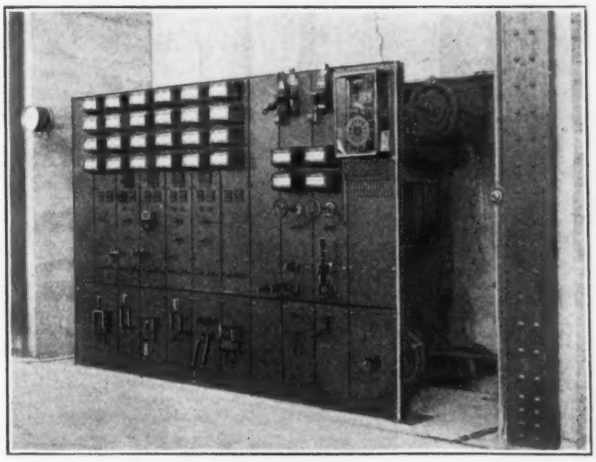


Fig. 6—Switchboards.

same side of the pole being 8 ft. and the remaining triangular spacing 10 ft. between wires.

The Bluefield transmission line crosses the Big Walker Mountains to the north of the group of developments and extends across the state line into West Virginia, reaching a terminus at Coalwood. Among the other towns served by this circuit are Welch, Keystone, Switchback, Bramwell, Simmons, Cooper and Pocahontas, W. Va., and Graham and Wytheville in old Virginia. Another circuit extends almost 45 miles due west to Saltville, passing Marion en route. Roanoke, 65 miles northeast of the step-up substation, is reached by a line that takes in Christianburg on the way, and from a point at the No. 5 site, 20 miles distant,

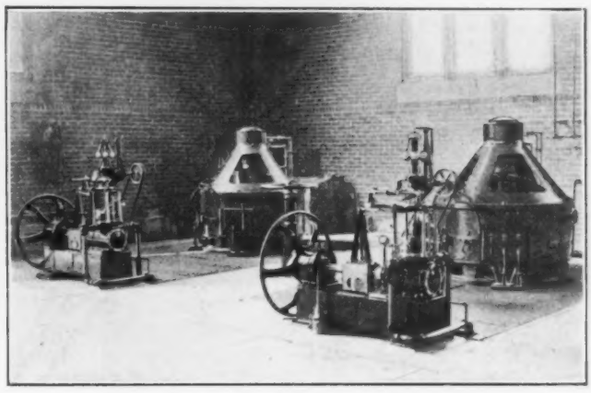


Fig. 7—Turbine-Driven Exciters in Power House No. 4.

an 88,000-volt tie line branches off to Bluefield by the way of Pulaski. Substations are in operation or being built at Roanoke, Pulaski, Bluefield, Switchback, Coalwood and Saltville. In the centers of the coal-mining load and at points like Wytheville and Galax low-tension substations have been built. For the secondary transmission circuits 13,200 volts has been chosen as standard.

SALE AND USES OF ENERGY.

The territory in Virginia and West Virginia centering about these two developments is rich in many varieties of minerals, including the famous Pocahontas coal, iron, zinc,

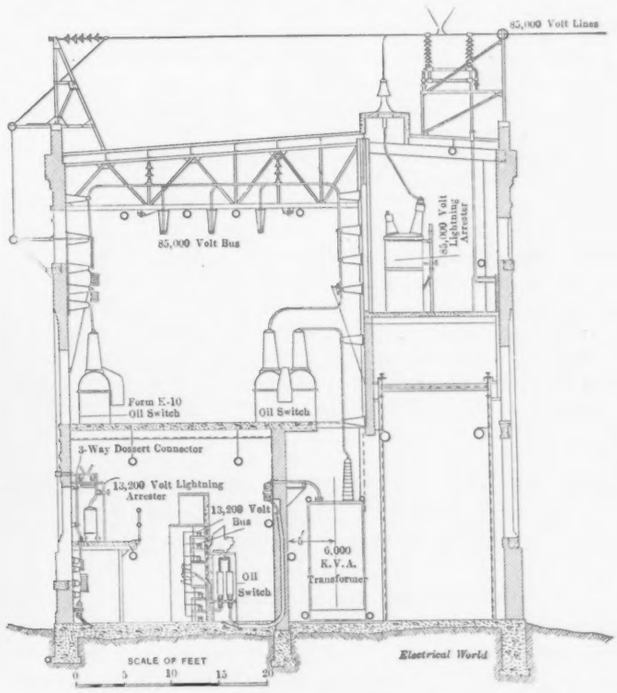


Fig. 8—Cross-Section of Step-up Transformer House.

copper, salt, gypsum, glass sand, clay, etc. With water-power available, the mining properties themselves are not only being developed at a more rapid rate, but the surrounding communities are feeling the stimulus and many industrial plants are being established.

The Appalachian Power Company has acquired the electric-lighting and street-railway systems of Marion, Wythe-

ville, Pulaski, Pocahontas, Welch and Keystone and the street railway at Bluefield, all of which are within 50 miles of the water-power developments. A contract has been closed with the Roanoke Railway & Light Company for energy to operate its system at Roanoke. The steam plant at this point will also serve as a relay station for an auxiliary source of power in case of interruption to the water-power operation.

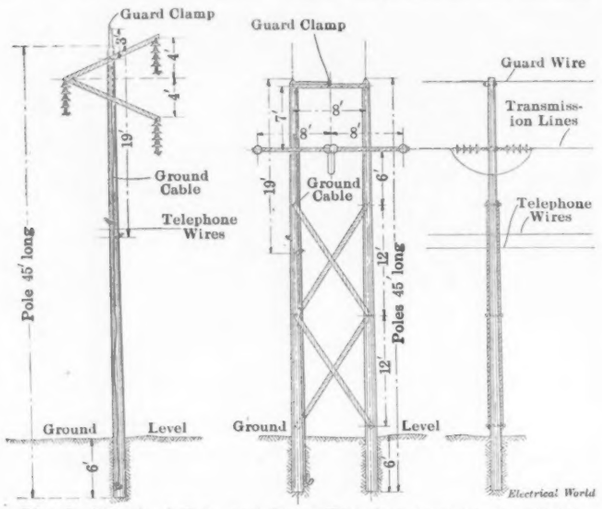


Fig. 9—Standard Pole and Dead-End Construction for 88,000-Volt Line.

By the terms of its contract with the Pocahontas Consolidated Collieries Company the hydroelectric corporation acquires the use of the collieries' 7500-hp steam turbine plant at Switchback, which will be employed as a reserve and to supplement power from the hydraulic developments. Other concerns in the coal fields which have contracted for the purchase of central-station energy are the Virginia Pocahontas Coke & Coal Company, the American Coal & Coke Company, the Zenith Coal & Coke Company, the Crystal Coal & Coke Company, the West Virginia-Pocahontas Coal Company, the Coaldale mines, etc.

The Appalachian Power Company is operated by H. M. Byllesby & Company, engineers and managers, Chicago. Mr. H. W. Fuller is vice-president and general manager of the power company, whose executive offices are at Bluefield, Va. Messrs. Viele, Blackwell & Buck, New York, were the consulting engineers in charge of construction of the plants, high-tension lines and high-tension substations above described. H. M. Byllesby & Company have had charge of engineering and construction in connection with the various electric plants purchased by the water-power company and the distribution systems in the coal fields.

THE THURY CONTINUOUS-CURRENT SERIES SYSTEM, WITH SPECIAL REFERENCE TO LONG-DISTANCE TRANSMISSION.

By Alfred Still.

In a previous article the writer described briefly the series system of power transmission by continuous currents as adopted for several European power developments and summed up the principal advantages and disadvantages of the system. The present article has special reference to straight long-distance transmission, because, although high-pressure direct current may be used on the loop system with any number of motors or motor substations distributed along the line—and, if desired, with any number of generating stations at suitable points on the loop—it will generally be found that a parallel constant-pressure system is preferable for covering a large industrial area, the simple reason being that, with the series system having a load more or less uniformly distributed along the loop, the system is a high-tension transmission at the start only, since the required voltage decreases with the distance from the generating plant. It is true that the cost of the insulation may therefore be less than for a system on which the pressure is high throughout, but that can be said of any low-tension system. The point is that in the case of the series loop serving a wide district with power taken off at intervals along the line the average pressure at which power is supplied to the motors or substations is only about half that which is supplied to the line where it leaves the power station. It must not be concluded that the Thury system is not well adapted to supplying several motor substations. It is an easy matter, as previously mentioned, to connect any number of motors in series on the line, but in order to get the full benefit of the series system these substations should all serve a comparatively small district at the distant end of the transmission line.

The question of sparking distances and the behavior of insulating materials when subjected to continuous-current pressures of high values is of the greatest importance when considering the relative values of the Thury system and the more common three-phase high-tension transmission. On the assumption of the theoretical sine wave, the maximum instantaneous value of an alternating emf is $\sqrt{2}$ times the root-mean-square value, and comparisons between alternating-current and direct-current transmissions are usually made on this basis, which makes the allowable continuous-current pressure to ground or between wires, for the same insulation and spacing, $\sqrt{2}$ times the working pressure of an alternating-current system. The ratio should, however, be based on experimental data, and, with a view to obtaining definite and conclusive information on this point, Mr. Thury conducted some years ago a very complete set of comparative tests with high voltages, both continuous and alternating. The results of these tests are probably more favorable to the alternating-current systems than would have been the case had they been conducted on existing high-pressure power transmission systems, because the experimental alternator used in the tests gave a rather flat-topped emf wave without any irregularities. The tests conducted to determine the comparative pressures at which various insulating materials would be punctured all tend to show that with continuous currents something more than twice

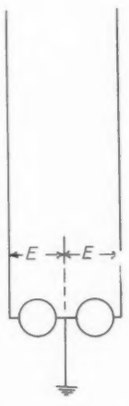


Fig. 1—Continuous Current.

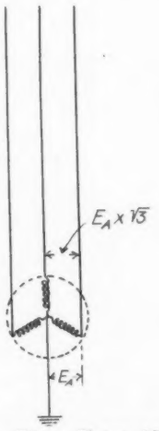


Fig. 2—Three-Phase Alternating Current.

the alternating pressure is required to puncture the insulation, and, in regard to sparking distances, the direct-current voltage necessary to spark over a given distance is, on the average, double the alternating-current voltage. In fact, this very complete series of tests seems to indicate that any existing transmission line designed for a definite maximum working pressure with alternating currents is capable of

being used to transmit continuous currents at twice this pressure. It is also interesting to note that insulators which become hot when subjected to high alternating-current voltages remain cool when tested with continuous currents. In fact, the leakage losses on the Thury transmissions are small. The total leakage loss over about 3000 insulators on the St. Maurice-Lausanne transmission (a distance of 35 miles), even in damp weather, is something on the order of 900 watts.

As an indication of what has been done in Europe since the introduction of the Thury system twenty-three years ago, it may be stated that there are at present about fifteen separate transmissions in operation, in Switzerland, Italy, France, Hungary, Spain and Russia. The shortest length of loop is 12.4 miles (Batoum, Russia), with a line pressure of 2600 volts. The longest is 224 miles (112 miles straight transmission), this being the Moutiers-Lyons line at a maximum pressure of 57,600 volts, which, however, may be doubled in the future. The average of all the working lines is a 50-mile loop and a pressure of 14,500 volts.

As an example of what might be done at the present time in the way of direct-current transmission, on a large scale, it is probable that no difficulty would be experienced in building dynamos of a large size with 5000 volts on one commutator. Assuming a current of 400 amp, which would probably be transmitted by two or more conductors connected in parallel, the output of each machine would be 2000 kw and two of these might be coupled to one prime mover. With twelve pairs of generators, the pressure between wires would be 120,000 volts and the maximum total output 48,000 kw. There would be very little new or experimental engineering work in connection with such a scheme.

It is usual to employ two insulated wires for direct-current high-pressure transmission, but under certain conditions it might be quite satisfactory to use the earth as the return conductor. The arrangement with two wires and the entire electric circuit insulated from earth is usual for pressures up to 25,000 volts. It has the advantage over any grounded system that any point on the circuit may become grounded without causing a stoppage, and repairs can readily be carried out by temporarily grounding two more points, one on each side of the fault. The facility and safety with which repairs on the high-tension system can be carried out by grounding the point where the work is being done is another advantage of this arrangement.

If a ground connection is made at both ends of the two-wire transmission, the ground wire being so situated as to balance the load as well as possible, an arrangement equivalent to the ordinary three-wire system is obtained. The pressure between wires may then safely be doubled because the potential difference between any one wire and earth can never exceed half the maximum pressure of transmission. On the other hand, some of the advantages of the ungrounded system are lost.

A direct-current transmission to any economic distance by means of a single wire, using the earth as the return conductor, is by no means an impossible scheme. The ground resistance is practically zero, the loss of pressure being almost entirely in the immediate neighborhood of the grounding plates. Tests made on the St. Maurice-Lauzanne line (35 miles) gave a total ground resistance of 0.5 ohm. Continuous currents of the order of 100 amp returning through the earth do not appear to be objectionable in any way. By taking the ground connections to a considerable depth below the surface the current density at ground level would everywhere be so small that interference with opposing interests would hardly be possible.

In order to study the relative costs of conductor material required for the series direct-current system and the more common three-phase alternating-current transmission, a basis of comparison is necessary, and the following assumptions will be made:

(A) Same distance of transmission; no tapping of current at intermediate points.

(B) Same total amount of power transmitted.

(C) Same power loss in conductors (losses due to leakage or capacity of lines are neglected).

(D) Same insulation used on both systems.

This last condition is practically equivalent to stating that the maximum value of the voltage shall be the same. It is proposed to consider the following four conditions:

(a) Same maximum pressure above ground; the direct-current voltage being $\sqrt{2}$ times the alternating-current single-phase voltage (sine wave assumed).

$$\text{Ratio } \frac{E_a}{E} = \frac{1}{\sqrt{2}} \tag{1}$$

where E and E_a stands respectively for the continuous and alternating voltages to ground. (See Figs. 1 and 2.)

(b) Same as (a); but direct-current voltage double the alternating voltage.

$$\text{Ratio } \frac{E_a}{E} = \frac{1}{2} \tag{2}$$

(c) Same pressure between wires; the allowable direct-current pressure being $\sqrt{2}$ times the alternating-current pressure.

$$\frac{\sqrt{3}\,E_a}{2E} = \frac{1}{\sqrt{2}}, \text{ or ratio } \frac{E_a}{E} = \frac{\sqrt{2}}{\sqrt{3}} \tag{3}$$

(d) Same as (c); but direct-current pressure double the alternating-current pressure.

$$\frac{\sqrt{3}\,E_a}{2E} = \frac{1}{2}, \text{ or ratio } \frac{E_a}{E} = \frac{1}{\sqrt{3}} \tag{4}$$

To satisfy the condition of equal total power, the equation is,

$$2E \times I = 3E_aI_a\cos\theta \tag{5}$$

and for equal line losses,

$$2I^2R = 3I_a^2R_a \tag{6}$$

where I is the current per conductor in the direct-current transmission, and R the resistance per mile of single conductor; while I_a and R_a are the corresponding quantities for the three-phase transmission.

In either system the total weight (and cost) of the conductors is proportional to $\frac{\text{number of conductors}}{\text{resistance of each conductor}}$ which gives the relation,

$$\frac{\text{Cost of conductors, direct-current system}}{\text{Cost of conductors, three-phase system}} = \frac{2R_a}{3R} \tag{7}$$

but R_a can be expressed in terms of R thus:

By (6)

$$R_a = \frac{2I^2R}{3I_a^2} \tag{8}$$

and by (5)

$$I = \frac{3E_aI_a\cos\theta}{2E}$$

or

$$I^2 = \frac{9E_a^2I_a^2\cos^2\theta}{4E^2}$$

which, when put for I^2 in formula (8), gives,

$$R_a = \frac{3E_a^2\cos^2\theta \times R}{2E^2} \tag{9}$$

Thus the equation given by (7) becomes,

$$\frac{\text{Cost of conductors, direct-current system}}{\text{Cost of conductors, three-phase system}} = \frac{E_a^2}{E^2}\cos^2\theta$$

Assuming the very common value of 0.8 for the power-factor of the three-phase system, the numerical ratio for the four conditions previously stated would be:

(a) For same maximum pressure to ground, with sine wave assumption,

$$\frac{\text{Direct-current cost}}{\text{Alternating-current cost}} = \frac{\cos^2\theta}{2} = 0.32$$

(b) Same as (a), but allowable direct-current pressure assumed to be *double* the alternating-current pressure,

$$\frac{\text{Direct-current cost}}{\text{Alternating-current cost}} = \frac{\cos^2\theta}{4} = 0.16$$

(c) For same maximum pressure between wires, with sine wave assumed,

$$\frac{\text{Direct-current cost}}{\text{Alternating-current cost}} = \frac{2}{3}\cos^2\theta = 0.426$$

(d) Same as (c), but allowable direct-current pressure assumed double the alternating-current pressure,

$$\frac{\text{Direct-current cost}}{\text{Alternating-current cost}} = \frac{1}{3}\cos^2\theta = 0.213$$

The transmission line, apart from the cost of conductors, would be cheaper for the direct-current than for the three-phase scheme because there are fewer insulators required and only two instead of three conductors to string; and if a grounded guard wire is erected above the conductors, it is more convenient to arrange this over the two direct-current conductors than over the three alternating-current wires, and it would not necessitate the same total height of tower. The important saving is, however, in the conductors themselves. Taking the figure most favorable to the direct-current scheme (b) the alternating-current conductors to transmit the same power with the same loss would cost six and a quarter times as much as if direct-current transmission were used, and even under the assumption (c) most favorable to the three-phase scheme the cost would still be 2.35 times the cost of the direct-current conductors. For the purpose of getting out preliminary estimates, it is certainly safe to assume that, if the power factor of the three-phase load may be taken as 0.8, the cost of conductors on a long-distance direct-current transmission would be only one-quarter of the cost of conductors with the alternating-current scheme on the assumption of equal I^2R losses. The fact that it would probably be uneconomical to allow the same losses in both cases does not render the comparison less interesting or valuable.

There are undoubtedly conditions in this country, as there are in Europe, which are favorable to the installation of the series continuous-current system, and it is not easy to understand why the three-phase alternating-current system should be adopted almost without exception on this continent while apparently little consideration is given to possible alternative methods of transmitting power to a distance. Of course, first cost of plant, operating charges and reliability have to be taken into account when comparing different systems, and the most satisfactory way of doing this is to reduce all estimated costs to the common basis of annual charges. The cost of the direct-current generators must be set against the combined cost of alternators and exciters and step-up transformers with all intermediate switchgear.

In regard to reliability it is true that, on the Thury system, the generators have not the protection against lightning disturbances which the step-up transformers afford to the alternators on high-tension three-phase systems, and where thunderstorms are prevalent this must not be overlooked, as the cost of protective apparatus may prove excessive. In this connection it is interesting to note that the charges of electricity in the upper atmosphere are always positive, and the negative wire will therefore tend to draw a lightning discharge away from the positive wire or grounded guard wire. But to how great an extent this would affect the proper disposition of the wires it is difficult to say.

STROBOSCOPIC EFFECTS OBTAINABLE WITH INCANDESCENT FILAMENTS AS ILLUMINANTS.

By C. F. Lorenz.

THE rapid fluctuations in the intensity of the light from incandescent lamps operated on alternating current are usually looked upon as an evil to be avoided, or at least held within such limits that flicker and the production of multiple images are not noticeable to an

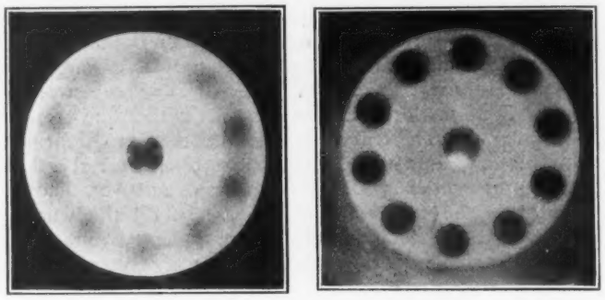


Fig. 1—Disks *a* and *b*.

objectionable degree. This is, of course, the proper view from the standpoint of lighting; in experimental and other work it is, however, often desirable to have a source of light which will reproduce as light fluctuations any fluctuations in the flow of electrical energy to it.

For this purpose use may sometimes be made of various types of illuminants, such as vacuum tubes, sparks, arc lamps, or the current-carrying acetylene flame,[1] and at other times to various devices, of which one example is an acetylene flame fed through a manometric capsule, the diaphragm of which is also the diaphragm of a telephone receiver, and another is the "light relay" used by Korn[2] in the electric transmission of pictures (a light shutter moved electromagnetically). All of the above have their limitations, so that it seems worth while to consider another possibility, namely, the use of wires made incandescent by the alternating or otherwise varying current—something in the shape of an incandescent lamp, which, if applicable, would have at least the advantages of convenience and reliability. The purpose of the present article is to indicate what results may be expected by working along this line. The frequencies at which such wires may be operated as light sources for stroboscopic work will, of course, be comparatively low, though it will appear that they are much higher than would at first sight be expected. This limitation to low frequency need not, however, prevent such

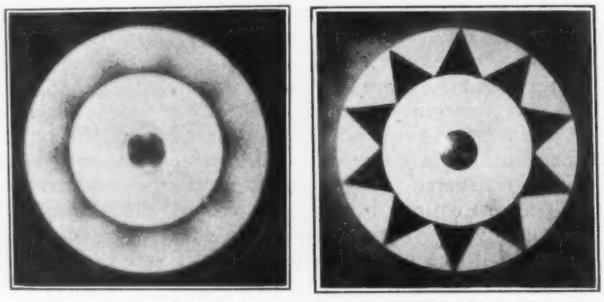


Fig. 2—Disks *c* and *d*.

sources from having a field of usefulness of their own. For excessively high frequencies one must fall back on the disruptive spark, which has long been the source used to get instantaneous views of very rapid processes (for example, the operation of fire-arms). In this connection may be

[1] *Phys. Zeit.*, Vol. 8, page 20; 1907.
[2] *Phys. Zeit.*, Vol. 8, page 18; 1907.

cited the recent work of C. Crantz and B. Glatzel,[3] who were able to obtain 100,000 photographs per second.

GENERAL CONSIDERATIONS AS TO STROBOSCOPIC EFFECTS.

In order to see what factors determine whether or not in a given case good stroboscopic effects may be obtained, consider a rotating disk provided with a number of dots or other marks equally spaced along the circumference of a circle the axis of which is the axis of rotation. If the disk is illuminated by an intermittent light of sufficiently high frequency and such that the interval of time between two illuminations is the same as that required for a point on the circumference to travel a distance equal to the distance between two dots, then the row of dots will appear stationary and the dots will appear with more or less distinctness, depending on the conditions of the experiment. If the illuminations are flashes of short duration—that is, if the ratio of the interval during which the source gives out light to the interval of darkness is small—then the marks will appear very distinctly and with sharp outlines no matter what the nature of the marks; in particular, no matter what the ratio of their width to their distance apart may be. This is not the case if the flashes are not instantaneous. If the marks consist merely of radial lines, so that the ratio of their width to their distance apart is small, and if the illuminations are not instantaneous flashes but endure for a considerable fraction of a period, then the lines may be so badly blurred that they will not show at all. If, on the other hand, the marks are broad, having a width say equal to half the distance between their centers, then they may be brought out very well by the same illumination which had too great a ratio of "light" to "dark" to show the narrow lines at all. This point is illustrated by the photograph *c* taken with the light from a 10-watt, 115-volt tungsten lamp fed with 30-cycle alternating current. During the exposure the disk was rotated at the proper rate by means of a synchronous motor. In this case the marks are triangles, such that the width of a mark varies from zero (apex of triangle) to the distance between marks (base of triangle). It will be noted that the stroboscopic effect shows best half way between the apex and base—that is, where the width of the mark is half the "pitch"—while the blurring is greatest where the mark is too thin and where it is too broad, namely, at the apex and base. The appearance of *c* when at rest is shown by *d*, which is also a time exposure, taken while the disk was rotating, but with an illumination consisting of sharper flashes. The disk *a*, on which the marks are fat dots having a diameter equal to one-half the pitch, was photographed under the same conditions as *c*.

It may be well in this connection to emphasize the distinction between "stroboscopic effect" and "flicker," both of which are associated with intermittent or fluctuating light sources. The former consists in the production of multiple images when objects viewed are moved while illuminated by the intermittent light, either giving the appearance of a number of objects strewn along the path along which the object actually is moved, as is the case, for example, when a knife blade is moved sidewise under an inclosed alternating-current arc lamp, or else causing the apparent standing still of a rotating object when the multiple images are suitably superposed—for example, a rotating commutator may appear to be standing still when it is in a dark corner and the intermittent light from a sparking brush illuminates it. Stroboscopic effects may be obtained no matter how high the frequency of the intermittent illumination, and the sharpness of the effect depends (for one thing) on the shortness of the duration of the successive flashes. Flicker, on the other hand, depends primarily on the frequency of illumination, not occurring if the frequency is above a certain limit, this limit depending in any partcular case on the intensity of the illumination, condition of the eye, and the like.

[3] *Ber. d. Deutsch. Phys. Ges.*, May, 1912: page 525.

EFFECTS OBTAINED WITH ORDINARY INCANDESCENT LAMPS.

Used in the ordinary way—that is, supplied with alternating current of commercial frequency and sine wave-form—even very thin filament lamps do not show multiple images to an extent that is troublesome from the standpoint of lighting, though rather marked effects may be obtained with them if conditions are suitably chosen. Thus the combination of such a disk as shown in *a* and *b* with a 10-watt, 110-volt tungsten or carbon lamp gives an effect that is sufficiently good for the detection of synchronism even if the frequency of the current supplied to the lamp is as high as 60 cycles per second (120 illuminations per second). Evidently there are two reasons for the lack of sharpness in the stroboscopic effect thus obtained. On the one hand, the energy input is (approximately) a sine-squared function of the time, growing and dying away gradually for each illumination instead of occurring in an interval of time that is a small fraction of the time between two successive illuminations, and, on the other, the heat capacity prevents the filaments from heating or cooling instantaneously.

Since the factor which retards and smooths out the temperature fluctuations is the thermal capacity of the filament, the first step toward making the latter useful as a source of light for stroboscopic work is to choose a diameter for the filament as small as possible, since reducing the diameter reduces the thermal capacity in a greater ratio than the radiation. Assuming that the diameter has been reduced as far as practicable, the following methods of further increasing the stroboscopic effectiveness suggest themselves:

Operating Filament at Excessive Temperature.—If the lamp is used at abnormally high voltage, one would expect the outline to sharpen on account of the increased rate at which the filament radiates its energy. On trying this experiment it was found that the sharpening effect, though easily noticeable, was not very great even though the voltage was doubled. Of course, the improvement, such as it is, is purchased at the cost of diminished lamp life. This effect is altogether distinct from the well-known fact in regard to "flicker," namely, that the ease with which the eye can detect flicker is a function of the brightness.

Use of Color Screens.—When a body is gradually heated to incandescence the emitted light consists at first practically entirely of radiations of long wave-length, giving the sensation of red, radiations of shorter wave-length being present only to a very small extent. As the temperature is raised the strength of radiation of all wave-lengths is increased, but the percentage change is greater for the short wave-lengths. The maximum of the "energy curve" shifts toward the shorter wave-lengths as the temperature is increased, and the reverse is true as the temperature is lowered. It is to be expected, therefore, that a lamp will give sharper stroboscopic effects when its light is filtered through a blue glass than when no filter is used, and similarly that a red glass will make the effect less sharp. This fact is readily observed, but on account of the loss of light involved in the use of the filter it will probably seldom be useful. The effect is worth mentioning, however, because it comes into play when the stroboscopic phenomena are photographed, the photograph showing the outlines a little more sharply than they appear to the eye, because the ordinary photograpic plate is "color-blind" to everything but the blue-violet end of the spectrum.

EFFECT OF OPERATING THE FILAMENT IN A GAS.

By far the most effective way of increasing the stroboscopic effect obtainable with the light of an incandescent filament is to immerse the latter in an inert cooling gas. Under the cooling action of the gas the filament temperature follows the fluctuations of energy input much more closely than when the filament is cooled only by radiation. Of course, the increased stroboscopic effectiveness obtained in this way is purchased at the cost of increased specific consumption, but this may in many cases be of no moment.

The fact that a gas surrounding a filament abstracts heat from the latter is, of course, a matter of common knowledge, experimental work along this line dating back to the experiment of Andrews (1840), who showed that a greater current was required to heat a platinum wire to a certain brightness in hydrogen than in a vacuum. For a given wire the greater the temperature of the wire the less is the proportion of the

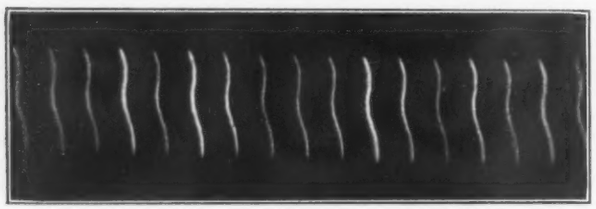


Fig. 3—View of Filament in Rotating Mirror.

heat lost by the wire through the cooling action of the gas compared with that lost by the radiation, this being due to the very rapid increase of radiation with temperature (fourth power for a black body). The ratio of the heat lost through the gas to that lost by radiation is not independent of the diameter of the wire, but is very much greater for a small wire than for a large wire. This fact is shown by all published experimental data bearing on the subject, falls in with the latest theory[4] in regard to the nature of the transference of heat from a hot body through a surrounding gas, and is very readily established by simple experiment. The result is that for obtaining stroboscopic effects from the light of an incandescent filament, for which purpose small filament diameters are chosen anyhow, the beneficial effect of operating the filament in a gas is enormous.

The photographs *b* and *d* were taken by the light from a piece of wire taken from a 110-volt, 25-watt tungsten lamp immersed in ammonia at one atmosphere pressure and supplied with intermittent current having the energy concentrated in sharp pulses (obtained by means of a ten-part rotary contactor mounted on the same axis as the disk). When *d* was taken the frequency of illumination was 60 per second, while for *b* the frequency was run up to 120 per second. The effect of the gas is further shown by Figs. 3 and 4, which record the appearance of the same filament as viewed in a rotating mirror. The gas in this case was ammonia at three atmospheres pressure; the current for Fig. 3 consisted of 120 sharp pulses per second, while for Fig. 4 it was ordinary 60-cycle current. It is observed that even in the latter case the light fluctuation is anything but sinusoidal, there being complete extinction during a large part of the period. This is, of course, explained by the fact that the light emitted by an incandescent solid varies much more rapidly than its temperature.

The above examples are given to call attention to the possible applicability of gas-immersed filaments in many

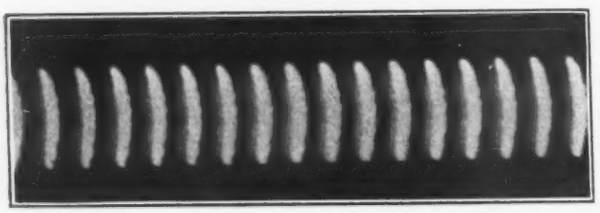


Fig. 4—View of Filament in Rotating Mirror.

cases when an illuminant is needed which is capable of responding promptly to variations in the electrical power supplied to it. The amount of gas in the bulb need not as a rule be so great as that used above and may in some cases be very small, and to avoid undue waste of energy should in any particular case be chosen as small as possible.

[4]Langmuir, *Phys. Rev.*, Vol. 35, page 401; 1912.

RESULTS OF LIFE TESTS ON TREATED AND UNTREATED CHESTNUT POLES.

Some years ago the United States Forest Service cooperated with the American Telephone & Telegraph Company in undertaking a long-period investigation of the seasoning and preservative treatment of poles with regard to their durability. Two pole lines built by that company, and known as the Warren-Buffalo line and the Poughkeepsie-Newtown Square line, were selected for the experiments. Periodical observations have been made on 1164 30-ft. chestnut poles set between Warren, Pa., and Dayton, N. Y., and on seventy-two 30-ft. chestnut poles set in the latter line near Flanders and Morris County Junction, in northern New Jersey.

The experimental poles for the Warren-Buffalo line were cut and peeled during 1902 and 1903 and then stacked in single tiers on skids about 2 ft. above the ground to season. In June and July of 1905 some of these poles were treated with various preservatives by the brush method, others were coal-tar creosoted by the open-tank method. The preservatives employed, the method of application and the absorption secured are given in Table I.

TABLE I.—METHOD OF TREATMENT OF POLES SET IN WARREN-BUFFALO LINE.

Condition When Set.*	Preservative Used, Sold as	Method of Treatment.	Absorption Secured per Pole.		
			Average, Lb.	Maximum, Lb.	Minimum, Lb.
Green		Untreated	.....	.....	.....
Seasoned		Untreated	.....	.....	.....
Seasoned	Coal tar	Brush, one coat	.....	.....	.....
Seasoned	Creolin	Brush, one coat	3.39	4.13	2.88
Seasoned	Creolin	Brush, two coats	7.60	10.63	5.50
Seasoned	Wood creosote	Brush, one coat	2.42	3.63	1.75
Seasoned	Wood creosote	Brush, two coats	5.43	6.63	3.25
Seasoned	S.P.F. carbolineum	Brush, one coat	3.55	5.13	1.38
Seasoned	S.P.F. carbolineum	Brush, two coats	4.38	6.63	3.00
Seasoned	Avenarius carbolineum	Brush, one coat	1.98	2.25	1.13
Seasoned	Avenarius carbolineum	Brush, two coats	4.52	6.63	2.50
Seasoned	Coal-tar creosote	Brush, two coats	7.77	11.75	4.13
Seasoned	Coal-tar creosote	Open-tank	22.41	44.0	8.00
Green	Coal-tar creosote	Open-tank	15.20	39.0	4.00

*Describes also the condition at the time the treatment was applied.

During August and September, 1905, 613 treated poles, together with 551 untreated seasoned and green poles, were placed in the Warren-Buffalo line, which extends at some places along roadsides, at others through cultivated fields, wood lots and meadows, presenting a variety of soil conditions. Poles of different kinds and treated according to the different methods were set in successive rotation in the line, in order that progressive changes in soil conditions might not destroy the value of comparison between the rates of decay on differently treated poles. Taking into account the green and seasoned poles, both untreated and treated by the brush and open-tank methods, there were thirty-four poles in each series, and the series was repeated twenty-four times.

Five years after placement of the poles in the Warren-Buffalo line they were inspected by the following method: After the soil was removed from the base of each pole to a depth of from 6 in. to 1 ft., the circumference was measured at or close to the ground line. Inasmuch as this measurement was made to determine the original circumference, which, unfortunately, had not been measured when the poles were set, the proper point at which to take the measurement was carefully chosen. After the first measurement each pole was carefully examined with a hatchet and prod for decay or insect injury. Decayed portions, if of any extent, were removed with a hatchet and a second

measurement of the circumference was then made at the point of maximum decay. This was generally found to be at or near the point selected for the first measurement. Poles which appeared to be sound but which rung hollow when struck with a hatchet were bored to determine the thickness of sound shell. After inspection the holes were closed up with creosoted plugs and the soil was replaced. The results of the inspection are summarized in Table II.

TABLE II.—CONDITION OF EXPERIMENTAL POLES IN WARREN-BUFFALO LINE AFTER FIVE YEARS' SERVICE.

Condition When Set.	Description of Poles.			Condition of Poles at or Near Ground Line.		
	Preservative Used, Sold as	Method of Treatment.	Number of Poles.	Affected with Decay.		Average Loss in Circumference at Ground Line, Inches.
				No.	Per Cent.	
Green		Untreated	194	194	100.0	1.16
Seasoned		Untreated	357	355	99.4	1.01
Seasoned	Coal tar	Brush, one coat	48	47	98.0	0.95
Seasoned	Creolin	Brush, one coat	16	16	100.0	0.89
Seasoned	Creolin	Brush, two coats	63	44	69.8	0.42
Seasoned	Wood creosote	Brush, one coat	21	20	95.2	0.43
Seasoned	Wood creosote	Brush, two coats	49	12	24.0	0.06
Seasoned	S.P.F. carbolineum	Brush, one coat	10	3	30.0	0.10
Seasoned	S.P.F. carbolineum	Brush, two coats	67	9	13.4	0.04
Seasoned	Avenarius carbolineum	Brush, one coat	8	2	25.0	0.27
Seasoned	Avenarius carbolineum	Brush, two coats	66	9	13.6	0.04
Seasoned	Coal-tar creosote	Brush, two coats	83	12	14.5	0.02
Green	Coal-tar creosote	Open-tank	29	0	0.00	0.00
Seasoned	Coal-tar creosote	Open-tank	153	1	0.65	Negligible

The experimental poles in the Poughkeepsie-Newtown Square line were inspected in July, 1910, approximately eight years after being placed. The method of inspection was in general the same as that used on the Warren-Buffalo line, except that the decayed portions near the ground line were first removed, after which three circumference measurements were made, one 5 ft. above, one 6 in. above and one 6 in. below the ground line. The results of this inspection are summarized in Table III.

TABLE III.—THE POUGHKEEPSIE-NEWTOWN POLE LINE.

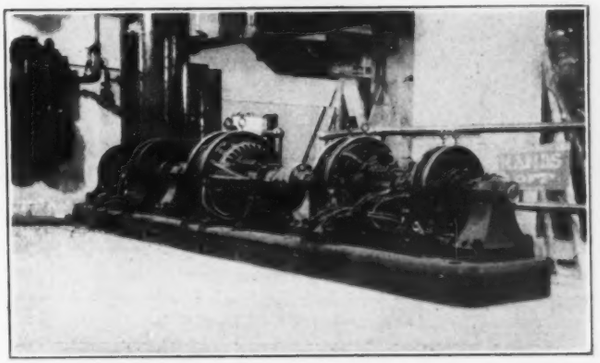
Total Number of Poles.	Preservative Used, Sold as	Method of Treating.	Character of Ground in Which Set.	Average Loss in Circumference at Ground Line, Inches.
10		Untreated	Sand	2.27
28		Untreated	Sandy loam	1.87
8		Untreated	Crushed stone	1.77
11	Spiritine	Brush	Sandy loam	1.68
10	Avenarius carbolineum	Brush	Sandy loam	1.63
5		Charred	Sandy loam	0.71

The following conclusions were deduced in reference to the poles set in the Warren-Buffalo line. Both the green and seasoned poles butt-treated with coal tar creosote by the open-tank process showed practically no decay at or near the ground line. The poles brush-treated with two coats of coal-tar creosote, and preservatives sold as avenarius carbolineum, S. P. F. carbolineum and wood creosote, showed but little difference in the extent of decay. The condition of these poles was next best to that of those treated with coal-tar creosote in the open tank. The poles subjected to the brush method of treatment with only one coat of preservative showed a much greater loss of circumference at the ground line than those treated with two coats. The untreated poles were practically all more or less affected with decay at the ground line and exhibited the greatest loss of circumference, the green poles being decayed on the average more than those which had been seasoned.

The untreated poles in the Poughkeepsie-Newtown Square line set in crushed stone showed less decay at the ground line than similar poles set in sand. The poles with charred butts showed less decay at the ground line than similar uncharred and untreated poles set in either crushed stone or sand. The detailed results of these inspections are presented in Circular 198 of the Forest Service, prepared by Mr. Carlile P. Winslow.

OFFICE-BUILDING PLANT WITH STORAGE BATTERY FOR NIGHT OPERATION.

The new eighteen-story building of the Modern Woodmen of the World, at Omaha, Neb., is being equipped with a Gould 140-cell storage battery to supply energy for the elevators and house lighting from midnight until 6 a. m., permitting the shut-down of the engine sets. In the engine room, in the basement, there have been installed three 110/220-volt three-wire units, of 85 kw, 175 kw and 250 kw rating respectively, all Crocker-Wheeler generators direct-connected to Harrisburg Fleming engines. The battery will be charged through a Ridgway five-unit set, comprising one 25-hp motor, two 50-kw, 30-volt boosters and two 1-kw, 8-amp generators, all mounted on one shaft and carried on a single base casting 16 ft. by 2.5 ft. The regulating cells will be controlled through a hand-operated end-cell switch.



Five-Unit Battery-Charging Set.

The Walker twelve-panel switchboard is provided with I-T-E circuit-breakers, Weston indicating instruments, Bristol recording voltmeters and Sangamo watt-hour meters. Six Otis passenger elevators have been installed to serve the eighteen stories.

For night ornamentation the cornice of the structure is marked by 120 150-watt tungsten lamps in reflectors, which burn until midnight. For renewing, these lamps can be reached with a long-handled replacer from the eighteenth story. Service is sold to tenants by meter, the Frank Adam panel boxes, one to each floor, enabling any of the thirty circuits to be connected under any of the seven meters. In these distribution boxes the meter risers are banked in two groups, between which are brought out the circuit contact studs. Switch clips inserted between the riser buses make the connection. The storage battery in the Woodmen's building is to be relied upon to furnish relay service in case of plant interruption, besides being used regularly to carry the small night load of elevators and hall lamps from 12 midnight to 6 a. m.

Messrs. Holabird & Roche, Chicago, were architects for the Woodmen's Building.

Central Station
Management, Policies and Commercial Methods

HOLIDAY ELECTRICAL DECORATIONS.

The approaching holiday season, with its customary festivities and decorations, presents another timely opportunity for the central-station solicitor to emphasize the safety and cleanliness of decorative electrical illumination. In this connection the National Fire Protection Association, 87 Milk Street, Boston, Mass., has issued a holiday fire bulletin containing warnings in reference to unsafe methods of decorating stores, churches, bazaars and homes for the Christmas season. For companies desiring to make use of the bulletin the association will supply it in quantities at $10 per 1000.

Light, inflammable decorations make fires easy to start and easy to spread. A match, a gas flame or an electrical defect may accomplish this. Gas jets are very dangerous because decorations may be blown against them by air currents. Electric lighting is by far the safest and the most sanitary. Christmas trees should not be decorated with paper, cotton or any other inflammable material, but only metallic tinsel or other non-inflammable decorations should be used, and the trees should be securely set up so that children in their excitement may not tip them over. Cotton should never be employed to represent snow; asbestos fiber is both safe and satisfactory. Candles are invariably dangerous and miniature electric lamps produce the same effect without the danger. It is well to remember that the Christmas tree itself will burn when the needles have become dry. A timely warning may also be given to householders not to make any change whatsoever in their electric wiring without consulting the electrical inspector for the district.

MOTOR-DRIVEN PADDLEWHEEL FLOAT CARRIES SWING BRIDGE.

An excellent illustration of the flexibility with which motors can be applied to temporary service is the pontoon operation of the foot-bridge used to span the North Branch of the Chicago River at Indiana Street, Chicago,

Fig. 1—Swing Bridge Carried on Motor-Driven Paddle Float.

during the reconstruction of the main bridge at that point. The temporary truss structure is of 12-in. by 12-in. wood beams and is 95 ft. long and 10 ft. wide. One end is carried on a huge iron pin and rollers bearing on the approach piles. The other rests on a 12-ft. by 24-ft. float or scow, equipped with motor-driven paddlewheels, enabling the span to be swung open to permit the passage of vessels. A 40-hp, 550-volt General Electric railway motor on the scow is geared to the paddle shaft, on which are mounted two 8-ft. wheels, each with eight 3-ft. blades. A housing on the scow protects the motor and gearing from the weather. The bridge tender's cabin is on the free end of the bridge at the street level and, besides the main switchboard, contains a standard railway-type drum controller with which

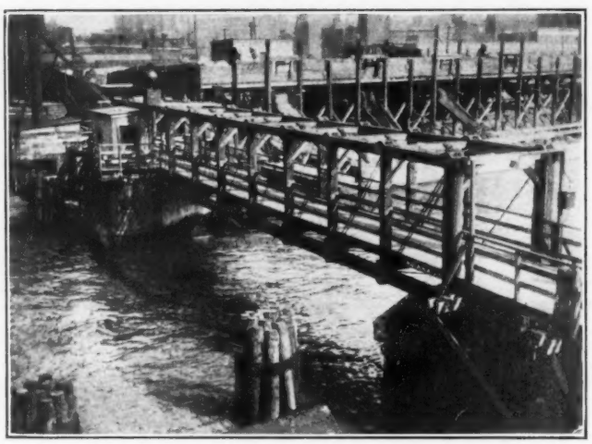


Fig. 2—Chicago Swing Bridge Turned by Motor-Driven Scow.

the motion of the bridge is manipulated. A 3-hp Robbins & Myers shunt-wound motor, operating a bilge pump for bailing out the hull of the scow, is also controlled from the tender's cabin. The bridge can be swung from closed to open position, or vice versa against the river current, in from thirty to forty-five seconds. Direct-current energy at 550 volts to operate the bridge is purchased from the Chicago Railways Company, being fed to the scow motors through flexible cables from the pivoted end of the bridge. This temporary foot-bridge will be in operation for a year or more until the new Indiana Street structure is completed. The design of both structures was carried out under the supervision of the Department of Bridges of the city of Chicago.

PRIVATE-GARAGE CHARGING RATES UNDER RESIDENCE CONTRACT IN ST. LOUIS.

One of the progressive electric-service companies that are doing much to encourage the use of electric automobiles is the Union Electric Light & Power Company of St. Louis. Its most recent effort in this direction is the promulgation of a plan which amounts to a reduction in rates for electricity for private garages. Energy to charge pleasure cars at home, using rectifiers or converters, is now furnished, if desied, under the residence contract, which makes possible a rate of 6 cents per kw-hr. after the first few hours' use each month. The monthly minimum bill is now only $1 at the most, and the service for the automobile charging can be connected through the regular residence meter, with no extra minimum, if desired. For truck installations the wholesale rate for electricity provides lower rates. The central-station company is advertising extensively this reduction in rates for private garages, and it makes the interesting statement that a four-passenger electric coupé can be operated as cheaply now as the old one-horse chaise.

One of the most important features of the new arrangement is the discontinuance of the old monthly minimum

charge on rectifier outfits. The electric-service company is co-operating with the electric-vehicle manufacturers and agents in St. Louis. When a prospective customer has signified his intention of purchasing an electric pleasure vehicle and rectifier, the central-station company will be glad to send a solicitor to the customer's residence if the vehicle man will notify the sales department of the Union Electric Light & Power Company. The company maintains an automobile department, of which Mr. C. E. Michel is the energetic manager, and it believes that electric-vehicle men should all act together. It declares that all electric cars are good, even though some may be better than others. It points out that one manufacturing concern cannot make all of the sales, and even when it finds that it is likely to lose a particular customer it will profit in the long run if it says a good word for the electric vehicle in general.

Where the garage is connected to the meter in the house the number of rooms in the garage will be added to the number of rooms in the house, and the energy for both the residence and the garage will be billed in accordance with the primary and secondary rates; that is, 10 cents per kw-hr. for the first 4 kw-hr. for each of the first four rooms or less, and 10 cents per kw-hr. for the first 2.5 kw-hr. for each additional room. By this method practically all of the energy used in the garage will be billed at 6 cents, which is the secondary rate.

Where a separate meter is used for a garage a separate residence lighting contract will be executed. The number of rooms in the garage will be counted and if, for example, there are three rooms, the bill for electricity will be on the basis of the first 4 kw-hr. for each of the three rooms; that is, 12 kw-hr. at 10 cents, or $1.20. For all energy in excess the rate will be 6 cents per kw-hr. If the number of rooms in the garage is six, the first 4 kw-hr. for each of the first four rooms would amount to 16 kw-hr. and the first 2.5 kw-hr. for the other two rooms would amount to 5 kw-hr., a total of 21 kw-hr., at 10 cents, or $2.10, as the primary portion of the bill, all the remainder being charged at 6 cents.

COURT-HOUSE SIGNAL LAMP FOR TOWN POLICE.

Attention was recently called in these columns to the arrangement of the switches controlling the "white-way" lighting at Marion, Ind., in the office of the chief of police, so that if burglars or footpads are reported in the downtown district the lamps can be flashed on while the officers scour the streets and alleys for the marauders.

To this system there has recently been added a red signal lamp on the court house tower, which can be seen from all parts of the city. Patrolmen are instructed to keep on the look-out for this lamp and if they see it burning they at once call headquarters by telephone. A sample set of flashing signals is also agreed upon to summon officers to the police station, etc.

ELECTRICITY "THE MATCH-LESS LIGHT."

To remind prospective and present users of electricity that "the match-less light," and it alone, is free from the dangers of asphyxiation and poisoning to which other modern illuminants are likely to contribute, a Western central station has had printed several thousand little stickers on the subject of matches, and these it is attaching to its literature. The legend follows: "The Matches That You Use.—What kind of matches are you using? More than 1000 children died in the United States during the past year from eating the tips of poisonous phosphorus matches. The destruction of $30,000,000 worth of property through fire was caused by them. Many of the employees in the factories where they are made are afflicted with a horrible disease called 'phossy jaw,' due to inhaling the phosphorus fumes. And the presence of such matches in the kitchen, where they are necessarily in close proximity to food, is now believed to be responsible for many cases of so-called ptomaine poisoning. Hadn't you better see about your matches?"

CO-OPERATIVE SIGN OPERATION IN LINCOLN, NEB.

Two large co-operative electric signs containing the advertisements of a number of local merchants have been operated successfully for nearly a year at Lincoln, Neb., and a third such sign is now being erected. These displays have proved to be good business for the central station, as well as the very best kind of publicity investments for the advertisers. Fig. 1 shows the first sign, installed by the Lincoln Gas & Electric Light Company, which still owns and operates it. This display measures 35 ft. by 50 ft. and contains 2200 lamps. The spectacular element is provided by the dragon designs with scintillating flasher effects. Between the dragons is an electrically lighted clock dial.

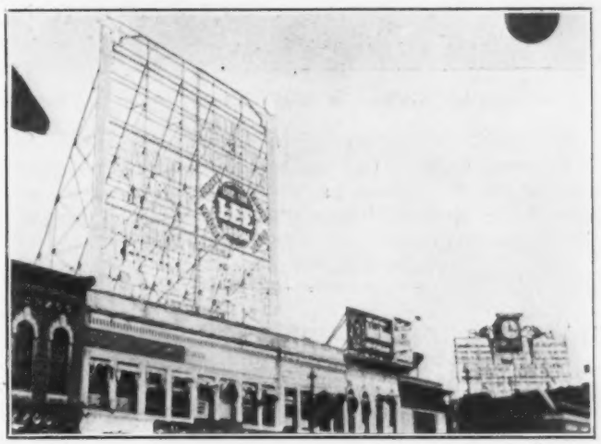


Fig. 1—Co-operative Electric Signs, Lincoln, Neb.

The 7-ft. by 14-ft. panel spaces are rented to local advertisers for $40 per month, netting a central-station income of 15 cents per kw-hr. For the firm name at the top of the display, above the clock, $20 a month is charged. The druggist pays $30 for his fifteen-letter line, and for each night the "Baseball To-morrow" sign is illuminated a charge of $1 is made. Tungsten sign lamps are employed in all the unflashed letters, and the display is substantially built on a steel framework. The electric company makes all renewals, and its commercial department controls the sale of space on the sign. Mr. J. E. Shuff is contract agent for the Lincoln Gas & Electric Company.

The second co-operative sign in Lincoln was promoted and installed by a large Western advertising company which itself solicits the advertisers, purchases energy from the Lincoln company at 4.5 cents per kw-hr. and rents the 14-ft. by 24-ft. spaces at $35 per month, supplying renewals, inspection, etc. This display measures 55 ft. by 51 ft. over all, including the huge white columns which flank the sign spaces, and contains 1600 tungsten lamps. Both this sign and that owned by the central station are installed on low roofs opposite one of the busiest street intersections in the city.

The advertising firm controlling the second sign is now arranging to install a third, reserving the display last described for a co-operative announcement of the various lines of goods sold by a local merchant. This dealer in men's clothing plans to contract for the entire sign, placing his store's name and address at the top and renting the six spaces below to six national manufacturers of clothing,

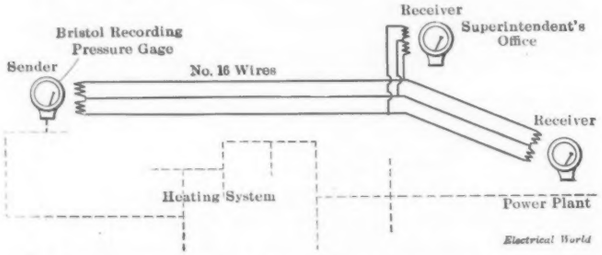
collars, shoes, underwear, etc., whose goods he sells. The merchant's name will appear also on each space, but the cost will be mostly defrayed by the manufacturers, each of whom will pay $35 per month. The difference, $70, necessary to make up the $310 per month which the owner of the

Fig. 2—Central-Station Co-operative Sign in Lincoln, Neb.

sign charges for operation and maintenance, will be met by the local dealer. The flasher equipment of this display turns on the six individual signs in pairs, thus assuring that each will be more carefully read besides improving the load-factor of the display.

STATION GAGE RECORDING HEATING PRESSURE AT DISTANT CUSTOMERS' PREMISES.

To insure good steam pressure on its heating mains the Peoria (Ill.) Gas & Electric Company has a recording Bristol steam gage installed at the end of its longest pipe line. This gage, by an ingenious electrical arrangement, is connected to similar recording-gage mechanisms in the heating plant 3 miles distant by pipe line, and also in the office of the district-heating superintendent, five blocks from the station, affording at both places a continuous indication and record of the pressure at the lowest point on the system. A minimum pressure of 1 lb. per sq. in. is required on all customers' installations, and with the furthest user obtaining this pressure sufficient heat is assured all intermediate customers. With the gage indication the



Recording Gages Controlled from Low Point of Steam-Heating System.

terminal pressure can be intelligently controlled and limited to the minimum requirements, saving unnecessary back pressure and waste. A similar recording-gage arrangement is also used on the gas lines of the company, the gas pressure in the downtown section being automatically reported at the governor room in the gas plant, a mile or so distant.

The scheme of control of these distant pressure recorders depends upon a principle of balanced inductances devised by Mr. J. W. Bard, formerly meter superintendent for the Peoria company.

The mechanism of the recorder introduced into a Bristol or similar gage consists of a pair of coils arranged on a form pivoted so that one coil can go deeper onto a laminated wire core, while the other moves off a similar core which it embraces. The frame carrying the coils is actuated by the moving pen of the instrument, attached to the usual Bourdon tube, and as the pen moves back and forth in response to varying steam or vapor pressure, one coil is moved deeper on its core as the other is moved farther off its corresponding core, and vice versa.

At the distant point is placed a recording mechanism like the sending mechanism, except that the steam-pressure tube is omitted and the pen arm is mounted on a bearing so that any motion of the frame carrying the movable coils may be transmitted to the pen arm and thus move the pen back and forth across the chart. One coil at the sending end is connected to one coil at the receiving end and the other coil similarly to the second coil, three connecting wires being required between the sending and receiving points. Sixty-cycle current is impressed on the circuit and the operation of the mechanisms is then as follows:

Assuming one coil at the sending end standing high off its core and the other low on its core, the first coil has small inductance and the second coil high inductance. In consequence a large current will tend to pass in the first coil at the distant end and a very small current in the second coil at the distant end connected to the second sending coil. The coils at the receiving end will immediately move to such position as to balance the inductance of the two coils at the sending end. By a proper proportioning of the coils, the mechanism at the receiving end can thus be made to duplicate the angular position of that at the sending end.

COMPRESSED AIR FOR STEAM HAMMERS.

A Louisville manufacturer recently shut down his steam plant and converted his factory to central-station drive, and by repacking his steam hammers he has been able to operate them successfully on compressed air. The equipment converted comprised a 1500-lb. and a 600-lb. hammer, and air is furnished by a two-cylinder Ingersoll-Rand compressor capable of compressing 372 cu. ft. of free air per minute to 120 lb. pressure per square inch. The compressor is driven at 175 r.p.m. by a 65-hp Allis-Chalmers motor. Running the larger hammer under test conditions and forging up forty 2-in. steel axles per hour, or as fast as the attendant could feed the work, the compressor motor consumed about 40 kw-hr. per hour, its demand varying slightly above and below 40 kw. In making the conversion from steam to air operation the only change necessary in the hammers was the repacking of their pistons.

TIPPING PUBLIC-SERVICE EMPLOYEES.

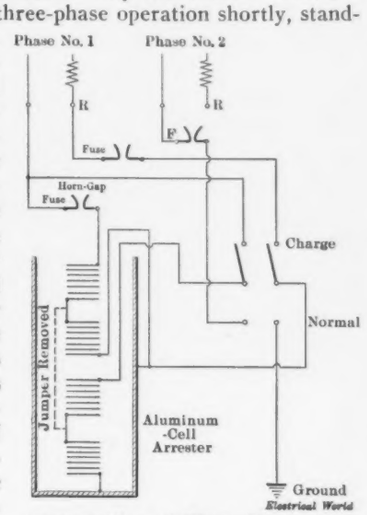
Complaint having arisen that employees of the San Diego (Cal.) Consolidated Gas & Electric Company had demanded and received tips from customers for connecting gas ranges, that company has dismissed the employees concerned, after a hearing, and as a protection against further annoyance of this sort has prepared a small card, to be handed to new customers, which bears the following notice:

"Patrons of this company are respectfully requested to offer no tips to employees as compensation for service rendered. Employees are prohibited from receiving tips, and the acceptance of a tip of any kind is considered cause for instant dismissal. No money should be paid any employee of this company except upon presentation of proper bill on printed form, and then only to regular collectors."

Wiring and Illumination

ADAPTATION OF THREE-PHASE ARRESTER FOR TWO-PHASE USE.

In purchasing lightning-arrester equipment for some two-phase circuits in several Kansas City substations which are likely to be changed to three-phase operation shortly, standard three-phase, 2300-volt aluminum-cell arresters were selected and adapted temporarily to two-phase operation as shown. For this two-phase protection the three-phase equipment, it will be noted, required only four elements instead of the six generally furnished. By the use of the connections shown both arresters are charged from a single phase, only one of the second-phase terminals being led to the arrester. This unconnected side and the corresponding side of the first phase are equipped with feeder regulators, the static arresters of which afford ample protection.



Reconnection of Three-Phase Arrester on Two-Phase Circuit.

As furnished by the manufacturer, the arrester comprised four groups of elements connected to a common point, with the far side of one of the groups grounded onto the cell. By removing one jumper the various group taps were made available for two-phase operation. With the charging-switch blades in the lower position both phases are connected through the cell to earth. With the switch up energy is taken from the first phase for charging both sets of arrester elements. This arrangement was devised by Mr. R. K. McMaster, electrical engineer of the Kansas City Electric Light Company, and the arresters are installed in the company's substations at Fourth and Central Streets and Thirty-first and Holmes Streets.

QUARTZ-TUBE MERCURY-VAPOR LAMPS FOR POWER-HOUSE LIGHTING.

Speaking on the subject of the quartz-tube mercury-vapor lamp before the Electric Club of Chicago on Nov. 14 Mr. George C. Keech, illuminating engineer of the Cooper Hewitt Electric Company, mentioned the use of these units (which have a mean-low-hemispherical efficiency of 0.25 watt to 0.3 watt per candle-power) in lighting local Chicago power houses. Six 770-watt quartz-tube lamps are installed in the Quarry Street station of the Commonwealth Edison Company, where they light an area 463 ft. by 56 ft., or 4321 sq. ft. per lamp. The lamps are hung 65 ft. above the floor and have been in service sixteen months, in this period burning 4300 lamp-hours. The total renewal cost has been $100, or about 0.3 cent per lamp-hour. Tubes as now manufactured, said Mr. Keech, have average lives of 3000 to 4000 hours, although certain record tubes have been in service 7000 to 8000 hours. Ultimate failure usually results from loss of vacuum, the degree of exhaustion in new tubes being about one in one million. Quartz tubes which have lost their vacuum can, however, be re-pumped several times, at a cost of $12 for each operation, before it is necessary finally to discard them.

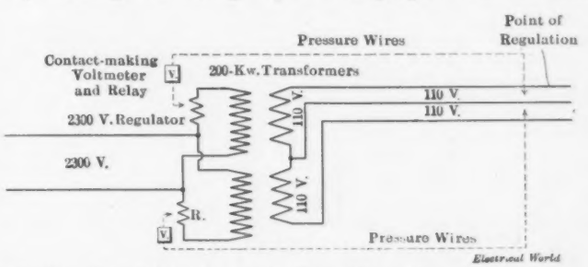
New uses for these quartz-tube lamps are being found in the industrial lighting of factories and yards, in photography and moving-picture manufacture, for bleaching, for forcing plant growth and for the sterilization of water and milk. After being cleared, the water to be sterilized is passed back and forth three times through the light of the lamp, receiving the full actinic rays, which effect the destruction of any bacteria present. An equipment manufactured in Chicago is capable of sterilizing 500 cu. m of water per day, using one lamp. Water containing, in the bacteriologist's parlance, 150,000 "bugs" per cu. cm is rendered absolutely sterile when it emerges from the apparatus. These quartz-tube lamps have also been used for testing fastness of colors in paints, etc., the bleaching action of the ultra-violet radiation being computed to have a fixed ratio to that of ordinary sunlight.

In the discussion which followed, Mr. Homer E. Niesz, Cosmopolitan Electric Company, Chicago, said that three quartz-tube lamps, supplied with direct current from a rectifier, have replaced twelve arc lamps and thirty-six incandescent lamps which formerly lighted the company's power station. For the arc and incandescent lamps, aggregating 9.6 kw, 2.6 kw in quartz units has been substituted, making a net saving of 7 kw. Not only are the illumination and diffusion better, said Mr. Niesz, but the saving of energy resulting will alone pay for the installation in eighteen months.

CONTROL OF THREE-WIRE SYSTEM WITH INDUCTION REGULATORS.

The downtown section of Peoria, Ill., is supplied with 110-220-volt alternating current over three-wire mains from a pair of 2300-110-volt, 200-kw transformers in the Peoria Gas & Electric Company's generating station. As the sketch shows, these transformers have their primaries paralleled and their secondaries connected in series to furnish the three-wire service. Owing to a former laxness in the requirements for the balancing of large lighting loads, Peoria has a number of 110-volt installations, besides other cases where the load is balanced floor to floor, all of which has made the balanced-pressure regulation of the three-wire system difficult, as the transformer bank is several blocks distant from the center of the load.

Regulation of the three-wire system is now satisfactorily accomplished, however, by contact-making voltmeters and relays which control the operation of the induction-regulator sets respectively cut into each primary side of the three-wire transformer circuits. This controlling equipment, which is in duplicate on each side, is adjusted to maintain the pressure at the distant point constant, in this way holding the voltage up to the proper value as well



Induction Regulators for Controlling Alternating-Current Three-Wire System.

as insuring a balance. Pressure wires brought back through the cables control the operation of the regulating equipment, which is all of Westinghouse manufacture. With currents of 600 amp to 800 amp flowing in the line, the regulators at all times effect a steady pressure balance of the system. Mr. L. Owen is electrical engineer for the Peoria company.

DISTRIBUTION-MAIN VOLTAGE DROPS IN KANSAS CITY.

A study of the various voltage drops in the primary mains of the Kansas City distribution system has been in progress for some time, until now complete maps and data are available showing pressure conditions over the entire system. The accompanying illustrations show the method of inserting the data on maps of the primary mains. Comparison of these two figures also illustrates the advantage obtained by a change in feeding point back nearer the station, resulting from a study of the voltage conditions involved in the first figure. In general, loads of less than 20 kw have been grouped together as a single large load, since the drop occasioned by such a load with standard wire sizes will amount to barely one-quarter of 1 per cent. This assumption, as pointed out by the electrical engineer of the company, Mr. R. K. McMaster, at the recent Kansas convention, greatly simplifies the calculations necessary.

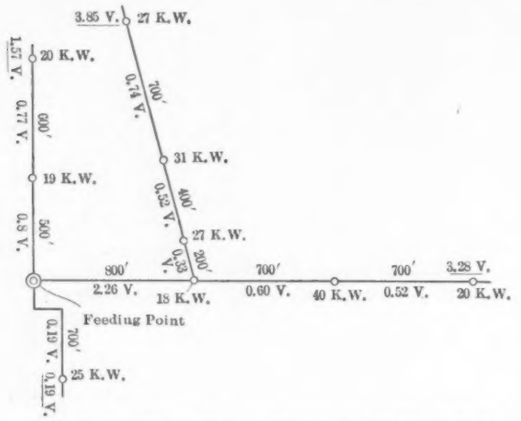


Fig. 1—Condition Before Change in Feeding Point.

Such calculations are more satisfactory than voltage measurements, the safe and necessary assumption only being made that the ratio of peak amperes to transformer kilowatt capacity for the entire feeder holds also for the individual transformers, unless the character of service varies widely in the given district. While feeder loads should be as heavy as practicable for the size of wire used, the desirable current densities will usually be independent of the wire's carrying capacity.

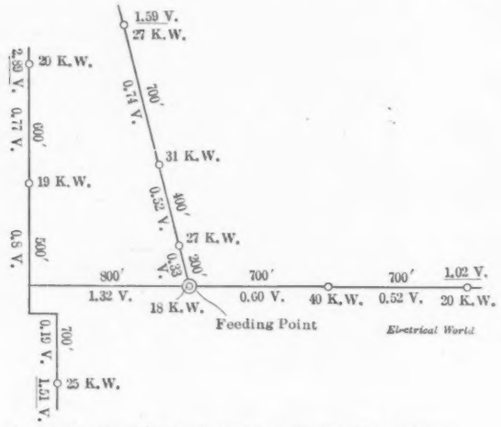


Fig. 2—Effect of Change in Feeding Point.

Because a system of mains has a reasonable maximum drop and a reasonable maximum current density in the wire it does not follow that it will not pay to make changes. Figs. 1 and 2 give an actual example of improvement to be obtained at practically no cost by moving the feeding point back nearer the station.

Above all, it is most important to keep down the line drop in the primary mains near the feeding point. If the drop in the first 1000 ft. of mains is 2 per cent, it may be reduced to 1 per cent by replacing 670 ft. with wire four times the size, at a cost trifling compared with the investment saving effected by permitting 1 per cent additional drop on long, lightly loaded primary mains, or 1 per cent additional secondary drop.

The most economical location of the feeding point with respect to the load center varies with the load density. In general, the feeding point should not be the load center, but that main which feeds back toward the station should be shorter than the others, in a ratio that is greater for dense than for scattered loads. About one-half is a good value for this ratio with loads of 200 kw to 400 kw per square mile.

REMOTE-CONTROLLED OPERATION OF PEORIA'S ORNAMENTAL LIGHTING.

The 240 five-lamp standards which light the downtown section of Peoria, Ill., are fed in groups of six to the curb block from the 110/220-volt alternating-current three-wire mains and are turned on and off by means of a remote-control pilot circuit which operates relay switches at the feeding points. By an ingenious arrangement a step-by-step mechanism permits the four 60-watt lamps or the single 100-watt units to be turned positively on and off, independently of the others, although only a single control wire is used.

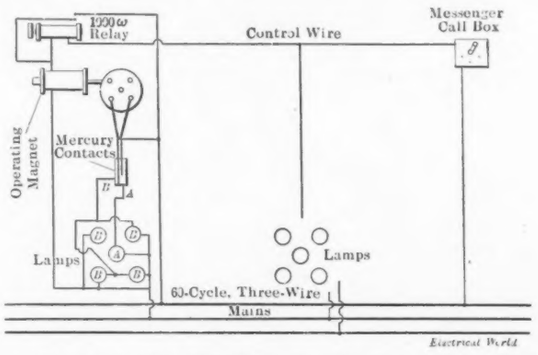


Fig. 1—Remote-Control Circuit for Peoria's Ornamental Lighting.

At each feeding point for a six-post block one of the relay switches shown (Fig. 2) is installed in a post base. It includes a 1000-ohm telephone relay, bridged between the control wire and the system neutral, and the 50-ohm switch magnet, whose winding is energized through the relay contact. This operating magnet works against the switch shaft, rotating it 90 deg. each time the magnet is energized. Pitman rods from this shaft control contacts dipping into the two mercury cups, one for the top-lamp circuit and the other for the lower lamps. The crank pins for these rods are also quartered 90 deg., as the sketch shows, so that in succession both contacts may be down, or one up and one down, or both up. This series of positions is passed in the course of one rotation, lighting first the lower lamps, then the top lamps, then extinguishing the lower lamps and finally extinguishing the top lamps.

Some difficulty was at first experienced in timing the impulses to operate all the relays and switches positively, but the mesenger call-box mechanism finally adopted solved this problem, the impulses now being fixed at about fifteen seconds' duration with five-second intervals. Another slight source of trouble has been the sensitiveness of the relays as first installed. A heavy blow to the switch post, such as a wagon riding over the curb, would cause a momentary closure of the contact, putting the corresponding circuit

out of step. But these minor difficulties have been speedily cleared out, and each switch before being installed received a test of 500 operations without a single failure. The switch mechanism is inclosed in a 6-in. by 10-in. iron box, 2 in. deep, with fiber entry bushings for the wires. The outfits cost about $12 each as made in a local shop. The No. 10 control wire which operates the forty switches has a total length of about 3 miles. Each relay takes about

Fig. 2—Switch Box Used in Post Base at Feeding Point.

0.1 amp, and the operating magnets 2 amp momentarily. Mr. C. A. Rich, foreman of the underground department for the Peoria Gas & Electric Company, devised the installation described.

FLAME-ARC LIGHTING IN OMAHA, NEB.

Omaha, Neb., has just completed the installation of 140 10-amp flame-arc lamps, placed four to the 350-ft. block. The downtown thoroughfares thus illuminated are: Twelve blocks, from Jones Street to California Street, on Sixteenth Street; eight blocks on Farnum Street, six on Tenth and four each on Fourteenth, Fifteenth and Douglass Streets. In each block the lamps, two on a side, are so staggered as to bring one unit to each 90 ft. of street length. They are hung from ornamental goosenecks 20 ft. above the street surface. In each block it was found possible to use one of the two former lamp-posts in its existing position, moving the other to a new location to conform to the installation of

Flame-Arc Street Lighting at Omaha, Neb.

the two new posts per block. The Omaha Electric Light & Power Company installed the entire system, including conduit, cable, posts, labor and repaving, for $15,000. This is, of course, exclusive of the lamps themselves, which cost $32 each. The Omaha company is under contract to do the city lighting for $75 to $85 per lamp year, but as the city receives a rebate in the form of a lighting assessment of 3 per cent of the company's gross income, besides a 3 per cent occupation tax payable into the general fund, the net cost per lamp year is but $68 to $70. According to the city electrician, Mr. Waldemar Michaelson, the cost of the present installation was met entirely from accumulations in this lighting fund. Omaha's flame-arc lighting is later to be extended to outlying districts of the city.

INVERTED MAGNETITE LIGHTING AT CINCINNATI AND CHATTANOOGA.

A trial installation of twenty-two "inverted" magnetite post lamps is in operation on Race Street, Cincinnati, demonstrating the use of these "New Haven units" for the complete downtown curb illumination of the city, to replace the tungsten lamps in refracting reflectors at first proposed. The new magnetite lamps are of the 6.6-amp General Electric type, carried on 15-ft. iron posts cast locally by the Electric Railway Equipment Company. A staggered arrangement has been adopted, the posts being spaced six to the block on each side of Race Street from Fifth to Seventh Street. The interval between posts is about 80 ft. along each curb, or one lamp for each 40 ft. of street. The section installed occupies the same blocks with the recent tungsten-post experimental installation using refracting reflectors, described in these columns at the time of its erection eighteen months ago.

Chattanooga, Tenn., is also to have a magnetite "white way" throughout its business district. The plans recently adopted call for 114 ornamental lamp standards with 6.6-amp, 75-volt units, similar to those used at Cincinnati.

CLUSTER LIGHTING REPLACES ARCHES IN COLUMBUS, OHIO.

For many years the downtown district of Columbus, Ohio, has been lighted by carbon-filament incandescent lamps supported from slender iron arches which spanned the streets from curb to curb. In its day this system of arch lighting produced an effect which was considered both novel and striking, but it rapidly became obsolete with the advances in outdoor lighting during the past few years. On the occasion of the city's recent centennial celebration

Fig. 1—Spring Street, Looking West from Fourth Street.

a new and modern system of cluster lighting was placed in service, in honor of the event.

The new curb-lighting system consists of 866 clusters mounted on ornamental iron posts, each bearing one 100-watt tungsten-filament lamp at the top, surrounded by four 60-watt lamps inclosed in ball globes of milk glass, as seen in Fig. 1. The lamps are wired on the multiple system throughout. In addition there are thirty alley lamps which

form part of the system. The entire installation is said to have cost approximately $101,500.

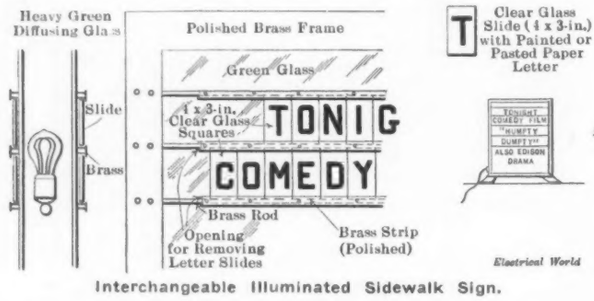
The posts were made by O'Brien Brothers, of Columbus, from a competitive design selected by the Merchants' Association. The Erie Lighting Company, Erie, Pa., received the contract for installation and wiring. Energy for operating the system is supplied by the municipal electric

Fig. 2—Chestnut Street, Looking West from Fourth Street.

plant. During the centennial the thirty-seven arches and 125 arc lamps in the cluster district were left in service to give extra illumination and decorative effect for the occasion. In connection with the ceremonies of throwing the switch which set the new installation in operation for the first time, Mayor Karb discoursed on the new era in street lighting and referred to the unique character of the old arches and the distinction which they had conferred upon the city in years gone by. But having served their purpose so well, and means of better illumination being now at hand, the change seems wholly fitting.

INTERCHANGEABLE ILLUMINATED SIDEWALK SIGN.

The accompanying sketch shows a simple interchangeable electric-lighted sign to be seen in front of a Kentucky moving-picture theater where the bill is changed nightly and the sidewalk announcement must be varied with equal frequency. There are two 2-ft. by 3-ft. panes of heavy diffusing green glass, mounted together in a polished brass frame with sufficient interval to admit the half-dozen lamps which light the display. Across the glass panes on each side are fixed brass rods, and extending to within about 4 in. of the brass frame on the edges polished brass strips



Interchangeable Illuminated Sidewalk Sign.

are fastened to these rods, forming slide-ways. In these grooves are placed the 3-in. by 4-in. clear-glass slides on which are painted the individual letters. If preferred, paper letters can be pasted onto the glass slides and used interchangeably to make up the words. The lamps inside the sign are lighted through an extension cord, and the display presents a brilliant appearance lighted from both sides.

RECENT TELEPHONE PATENTS.

ANTISEPTIC DEVICE.

An antiseptic device of paper has been invented by Mr. C. V. Fuller, of New York City. The paper is pressed into a cone-shaped form and its middle layer is adapted to absorb an antiseptic solution. The size of the cone conforms to the standard mouthpiece, the edges being bent over in a manner such as to lock over its lip.

TRANSMITTERS.

Mr. J. J. Comer, of Chicago, has devoted his attention to the production of a differential transmitter. He has worked this out in several different forms and obtained three patents covering it. The main principle is that of mounting the movable electrode midway in the carbon-granule chamber so that granules will lie on both sides of it. It will thus be seen that when the electrode is agitated the granules on one side are compressed simultaneously with the release of the granules on the other side. Thus by the use of two electrical circuits the current may be augmented in one while decreased in the other. The various types of instrument described comprise a stationary granule chamber with a moving middle electrode, a stationary middle electrode with granule chamber driven by the diaphragm, and a double granule chamber, one portion on each side of the diaphragm, and two middle electrodes, with either electrodes or granule chamber stationary. Mr. Comer's patents are assigned to the Automatic Enunciator Company.

A sheet-steel wall set is the subject of a patent granted to Mr. R. H. Manson, of Elyria, Ohio, and assigned to the Dean Electric Company. It is the idea to produce a set the elements of which may be used either assembled or individually. To this end the bell box which carries the transmitter in its face is provided with a hollow sub-base, which in turn is mounted upon a sheet-steel back-board with the usual shelf. The bell box may be used as a whole set, the back-board being dispensed with, or it may be used with a back-board. This interchangeable scheme permits of less stock being carried.

Letter to the Editors

SKIN-EFFECT COEFFICIENTS.

To the Editors of the Electrical World:

Sirs:—There seems to be considerable discrepancy in the published values of skin-effect coefficients, especially for the larger sizes of conductors at 60 cycles. Del Mar, in "Electric Power Conductors," and Pender, in "Foster's Electrical Engineers' Pocketbook," base their calculations on the product of circular mils by frequency. Their values are in substantial agreement. For 2,000,000-circ. mil copper Del Mar's value becomes 1.29 and Pender's 1.31. For 1,000,000-circ. mil copper Del Mar's value becomes 1.09 and Pender's 1.10.

Kelvin's values in the "Standard Handbook," based on diameter, interpolate as follows:

2,000,000-circ. mil, stranded diameter 1.944 value 1.77
1.000,000-circ. mil, stranded diameter 1.152, value 1.17

Rushmore's values, as given in the June, 1912, *Proceedings* A. I. E. E., interpolate from the curves published as follows:

2,000,000-circ. mil, stranded diameter 1.944, value 2.15
1,000,000-circ. mil, stranded diameter 1.152, value 1.23

There is over 60 per cent discrepancy between the lowest and highest values for 2,000,000-circ. mil cable. Where such discrepancies exist it seems as though the various authorities should attempt to "get together" on values they can all agree upon.

Cleveland, Ohio. H. S. Wallau.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Turbo-Converter.—F. CREEDY.—An illustrated paper read before the Manchester Section of the (British) Institution of Electrical Engineers in which the author describes a new method for avoiding the difficulty of collecting current from the commutator of a turbo-generator. The turbo-converter consists of an induction generator combined into one machine with a rotary converter, one member (preferably the primary) being mounted on the converter shaft and revolving with it, and the other (usually the squirrel-cage rotor) being mounted on the turbine shaft. Fig. 1 shows a diagram of the connections. In the case of a four-pole generator and four-pole converter let the converter be running at 1500 r.p.m., and let the three-phase induction generator be connected to three-phase tappings on the converter armature through the hollow shaft. At 1500 r.p.m. three-phase currents at 50 cycles will flow through the tappings on the converter armature. These tappings are so connected that the revolving field of the induction generator rotates the same way as the converter armature. In a four-pole machine with 50-cycle excitation the revolving field will also go at 1500 r.p.m., relative to the primary winding which produces it. Hence the total speed of the revolving field will be 3000 r.p.m. The squirrel-cage rotor, and, therefore, of course, the turbine, will go at approximately the same speed as the field. Hence this is an apparatus in which the generator runs at only a fraction of the speed of the turbine. Since the driving torque of the induction generator also drives the converter as a direct-current generator, the torque exerted between the rotor and the stator of the induction generator must be identically equal to that between the armature and the field of the converter. They are, in fact, the same torque exerted at different points. The author gives characteristics of such a turbo-converter design.—London *Electrician,* Nov. 8, 1912.

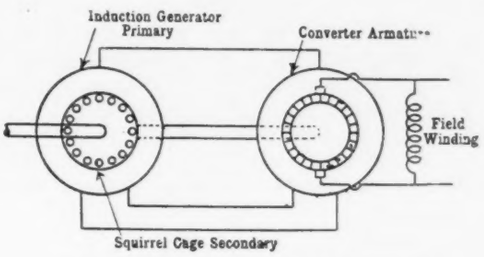


Fig. 1—Connections of Turbo-Generator.

Determining the No-Load Losses of a Machine.—A. YTTERBERG.—The author first discusses the well-known method in which the air, bearing and iron losses of a machine are determined by letting the machine run down from full speed to rest and measuring the speed at any moment. What is really wanted, however, is not the speed but the retardation. The author shows how this can be determined directly by simple electrical measurements. In Fig. 2, *M* is the machine under test. This is coupled with a small 1/20-kw direct-current generator *D*, which is separately excited from a storage battery. The brushes of the generator are connected to the voltmeter *V* and to the ammeter *A* in series with the condenser *C*, as shown in the illustration. The ammeter shows a current which is directly proportional to the torque at any moment while the voltmeter shows at the same time the speed of the machine. Both instruments are read simultaneously at proper intervals. The method is especially suitable for determining the speed curve in starting a machine, as it shows exactly all the irregularities in the change of speed, etc. By using a cinematograph or an oscillograph the curves can be plotted automatically.—*Elek. Zeit.,* Nov. 7, 1912.

Mercury-Vapor Rectifier.—BELA B. SCHAEFER.—An illustrated account of recent progress made in Germany in the construction of mercury-vapor rectifiers of large output. For larger outputs it is necessary to give up the use of glass and to employ metallic containers. The author uses a steel cylinder and for the gas-tight fitting he uses an asbestos packing with a layer of mercury on the outside. Considerable trouble was experienced in the development of large-size rectifiers from the phenomenon of "back-lighting." In general the valve action of the rectifier is perfect, but at times it suddenly ceases and the current passes in the reverse direction. This action means a short-circuit. Extended experiments showed that this may be due to three different causes. Either the pressure in the evacuated vessel becomes too high or the anodes are touched by condensing globules of mercury, thereby assuming the property of a cathode, or the anodes are touched by the conducting vapor current which rises from the cathode. In order to overcome these difficulties the construction shown in Fig. 3 is used. The mercury cathode is at the bottom in the center, while the anodes are not placed in the axle of the cylinder but near the walls at the top of the evacuated vessel as shown. In this way it is also possible to place several anodes within the vessel. A cooling chamber is placed on top of the evacuated vessel. The author gives figures which show that the mercury-vapor rectifier is from one-fourth to one-third as heavy as an ordinary converter. The first rectifier of this kind was installed in an iron foundry in Frankfort last year for 80-kw rating and has been constantly working since for ten hours every day.—*Elek. Zeit.,* Nov. 7, 1912.

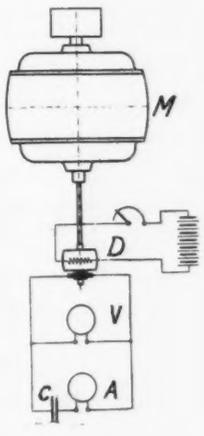


Fig. 2 — Method of Determining No-Load Losses.

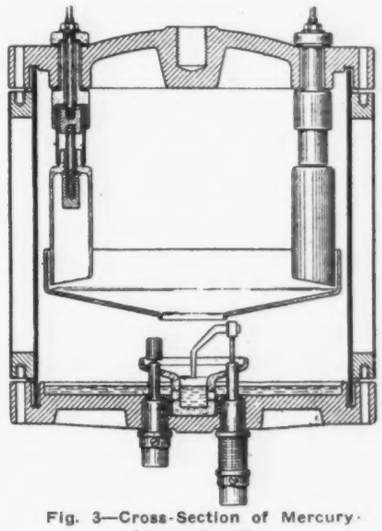


Fig. 3—Cross-Section of Mercury-Vapor Rectifier.

Phase Compensation of Induction Motors.—A note on a recent British patent (No. 28,383, Oct. 31, 1912) of Brown, Boveri & Company. A commutator machine, which may have an adjustable air-gap, is connected to the induction motor so that its rotor and the external system of the commutator motor rotate together. The magnetic system of the latter is highly saturated throughout or in parts, and the degree may be varied.—London *Elec. Eng'ing,* Nov. 7, 1912.

Lamps and Lighting.

Lighting with Three-Phase Lamps.—Walter Schaeffer.—The author first considers the general requirements of lighting large areas, like streets, squares, etc. He then compares the use of 3000-cp two-electrode ordinary flame-arc lamps with the use of 12,000-cp three-electrode three-phase lamps. The former are suspended at 9 m (30 ft.) above the ground and the latter at 18 m (60 ft.) above the ground. The comparison is carried out both for three-phase lamps with electrodes of 9 mm (23/64 in.) thickness and with electrodes of 12 mm (15/32 in.) thickness. The comparison is made for lighting an area of 180 m by 270 m, in one case with six 12,000-cp three-phase lamps and in the other case with twenty-four 3000-cp two-electrode lamps. Under all circumstances the use of three-phase lamps results in a great saving compared with the ordinary two-electrode lamps. The saving of electrical energy amounts to 50 per cent for the 9-mm electrodes and 33⅓ per cent for the 12-mm electrodes. The saving in the cost of carbon renewals is 60 per cent. The saving in the cost of attendance is 60 per cent for the 9-mm electrodes and 80 per cent for the 12-mm electrodes. The first cost of the installation is reduced by 50 per cent.—*Elek. Zeit.*, Nov. 7, 1912.

Exhaustion of Incandescent Lamp Bulbs.—An illustrated description of the system of A. Stifter for automatic current regulation during the exhaustion of incandescent lamps. The apparatus provides for the automatic switching in of lamps when such a vacuum has been attained that the filament may be safely brought to incandescence, and also for automatic opening of the supply circuit in the event of the explosion of a bulb or serious deterioration of vacuum by leakage in a bulb or its connections. The attendant's duty is limited to mounting and sealing off lamps. Referring to Fig. 4, the mercury-vacuum meter *a* controls a local circuit containing the switch *d*; the resistors b_1 . . . b_7 are of any convenient resistor material and are provided with intermediate platinum contacts fused through the wall of the vacuum gage. When the mercury has risen to a height

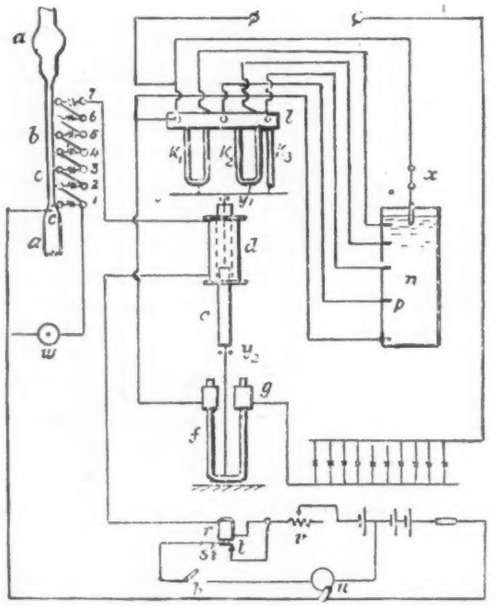
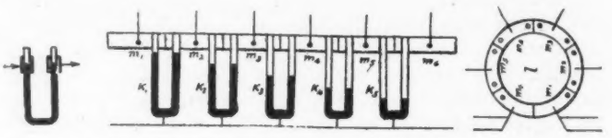


Fig. 4—Automatic Current Regulation for Incandescent Lamps.

corresponding to that vacuum at which the lamp can safely be brought to incandescence the contact *c* is closed and the current path is from the local battery through the whole of *b* and the coil *d*. The core *e* is then raised so far that the conducting part of the U-bar *f* (see also Fig. 5) is drawn into the mercury cups *g*, thus closing the lamp circuit. If the filaments have been mounted properly they now become duly incandescent, and the switch *h* in the alarm-bell circuit is closed. Above the coil *d* is an insulating plate *i* carrying contact bars k_1, k_2, the construction of which is shown in Fig. 6, which imagines the ring of bars developed into one plane. The actual arrangement is shown in plan in Fig. 7 At the moment when f closes the lamp circuit these contact bars make no connection between sections m_1, m_2, etc., of



Figs. 5, 6 and 7—Details of Arrangements for Automatic Current Regulation.

the ring *l*, hence, for the time being, the lamp current traverses the whole of the liquid-resistor column *n*. Meanwhile the lamp vacuum is increasing, and when the mercury level in the vacuum gage reaches *o* the section b_1 or *b* is short-circuited, and, the current through *d* being thus increased, the core *e* is raised further and the conducting limbs of *k* make contact between m_1, m_2, thus short-circuiting part of the resistor *n*, with the result that the lamps burn more brightly than before. The same cycle is repeated till by the time the mercury in the vacuum gage reaches *b* the whole of *n* is short-circuited and the lamps are supplied at 10 per cent over-voltage. Suppose now that a lamp explodes or a leakage occurs during the exhaustion, the mercury level in *a* at once sinks below c, the coil *d* is cut out of circuit and the lamp current is rapidly reduced as $k_1 k_2$, etc., descend, and finally the switch *f* is opened. The core *e* descends under its own weight and that of the contact gear; no control spring is used. The opening of the control circuit permits the armature of *r* to fall, with the result that the alarm bell *u* at once commences to ring and attracts the notice of the attendant, who opens *h*, remedies the defective condition and recommences the exhaustion. At most one lamp is lost. When dealing with lamps of abnormal voltage or candlepower a second liquid resistor may be connected in series or parallel with *n* after opening the switch *x*. It is sometimes recommended that lamps should not be brought to incandescence until the residual pressure of gases in the bulb has been reduced to 0.00013 atmosphere, but experience shows that no damage occurs if filaments are brought to incandescence when the pressure reaches 0.00262 atmosphere. It is especially important that the point *c* be correctly chosen so that the lamps are switched in immediately, but not before, that vacuum is reached at which the filament can be brought to incandescence without injury. Details are given of the construction of the standard vacuum gage.—London *Elec. Review*, Nov. 1, 1912.

Vapor Lamps with White Light.—M. Wolfke.—A French illustrated translation of his German paper recently abstracted in the *Digest* on a new vapor lamp emitting white light, a cadmium-mercury amalgam being used in a fused quartz globe.—*La Revue Elec.*, Oct. 25, 1912.

Generation, Transmission and Distribution.

28,000-hp Steam Turbine.—An illustrated note on a large steam turbine built by Escher, Wyss & Company for the central station in Essen. At 1000 r.p.m. its output is 22,500 effective hp, with an admission steam pressure of 10.5 atmospheres above atmospheric pressure, a steam temperature before the admission valve of 300 deg. C. and a vacuum of 91.5 per cent. The turbine can develop 28,000 hp and for a certain time even 30,000 hp. It has fourteen wheels which with the axle form a rotor 26,000 kg (57,200 lb.) in weight. The rotor of the Siemens-Schuckert generator is coupled rigidly to the axle of the turbine and weighs 60,000 kg (132,000 lb.). For their attendance the turbine, generator and condensing plant require three men, who are not fully occupied all the time.—*La Revue Elec.*, Oct. 25, 1912.

Traction.

Electro-Pneumatic Brake.—W. V. TURNER AND P. H. DONOVAN.—The conclusion of their long Franklin Institute paper on the electro-pneumatic brake system for steam-road service. The authors conclude, first, that the greatest gain in every way can be had by adding the electric control to the most improved form of pneumatic brake; second, that it should be applied to both the service and emergency functions of the brake; third, that it should not be applied to the service brake only, but may be applied with considerable gain to the emergency brake only, and, fourth, that the application of electric control to the brake will contribute to safety, economy and comfort to a degree impossible of attainment with a strictly pneumatic brake and to an extent far beyond any consideration of expense or complexity.—*Journal of Franklin Institute,* November, 1912.

Installations, Systems and Appliances.

Mercury Switch.—A description of a mercury switch designed by H. S. Hatfield in which the glass globe will not deteriorate in course of time. In Fig. 8 *G B* is the glass bulb, *M* mercury, *P E* platinum electrodes and *A* a porcelain cup. The tubes receive a special annealing treatment and

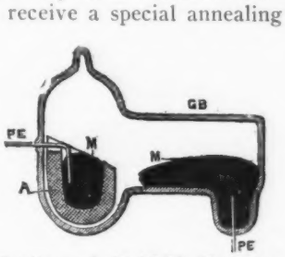


Fig. 8—Section of Hatfield Mercury Switch.

are tested for air-tightness and strain in the glass. The spark of break is taken up on the small porcelain cup *A*. The illustration is full size for 10 amp, and 500 volts are broken with certainty. How rapidly the break may be repeated depends upon the nature of the circuit; once a second is not too much on a load of incandescent lamps. London *Elec. Review,* Nov. 1, 1912.

Domestic Uses of Electricity.—G. DETTMAR.—The conclusion of his long paper giving details of the use of electric heating and cooking appliances in the author's household and also of his lighting equipment. Figures are given for the consumption of electric energy by different heating and other appliances.—*Elek. Zeit.,* Nov. 7, 1912.

Wires, Wiring and Conduits.

Starting Rheostats.—E. JASSE.—A French translation of his German paper recently noticed in the *Digest* on a method of calculating the most advantageous dimensions on starting rheostats so as to prevent their becoming unduly hot and so as to reduce their weight to a minimum.—*La Revue Elec.,* Oct. 25, 1912.

Aluminum Conductors.—HUBER STOCKAR.—His complete paper read before the Turin Congress of Applied Electricity on the use of aluminum for electric conductors. The author deals with both bare aluminum wires and insulated cables and gives the different properties in comparison with copper. His conclusions are as follows: Aluminum conductors must be installed in conformity with the characteristic properties of aluminum. While their method of installation is different from that of copper, it is not any more difficult. The use of aluminum and copper in the same line does not involve any detrimental lack of homogeneity. At the present prices of aluminum and copper the economy possible with the use of aluminum is so great that it should be taken seriously into consideration in practice. The economy is greatest for bare wires, somewhat less for lines with large sections and medium spans, less for transmission lines of great length, especially with sections of 100 sq. mm (0.155 sq. in.) and more, and still less for insulated cables with a large conductor section and an insulating material other than rubber. For interior wiring with small cross-section aluminum does not offer any remarkable economy. For telephone and telegraph wires aluminum does not seem to be applicable for mechanical reasons. For conductors buried in the earth aluminum is not applicable on account of chemical attack.—*La Revue Elec.,* Oct. 25, 1912.

Bracket Construction for High-Tension Lines.—An illustrated description of the Giros and Loncheur Z-bracket used on the 215 miles of 10,000-volt single-phase electric railways radiating from Limoges in the Haute-Vienne district. Its advantages include cheapness, lightness, strength and flexibility.—London *Elec. Review,* Nov. 1, 1912.

Electrochemistry and Batteries.

Saturation Currents in Selenium.—F. KAEMPF.—If an increasing voltage is applied to a selenium cell, then the current does not rise in proportion to the voltage, but more rapidly; that is, the resistance of the cell decreases. Characterized as it is by a more rapid rise of the current in proportion to the voltage, this reduction recalls what happens in the surface ionization of gases, where for small voltages the current increases as the square of the potential difference. If this analogy is more than a mere accident the conductivity of selenium and similar substances may be regarded as the superposition of a proper conductivity due to dissociation and a conductivity developed at the junction of the selenium and the metallic electrodes. The author undertook to examine the consequences of such a view, and especially to test the possibility of obtaining saturation currents in selenium. The present communication gives the proof of the existence of such a saturation current. The saturation current requires a very high potential gradient, something like 12,000 volts per centimeter.—*Phys. Zeit.,* Aug. 1, 1912, translated in London *Electrician,* Nov. 8, 1912.

Roentgen Radiation.—H. PEALING.—A paper on the distribution and quality of the secondary Roentgen radiation from carbon. The variation of the distribution of the scattered radiation produced in carbon by means of Roentgen rays differing in penetrating power was investigated, and unexpected results were obtained. When hard portions of a hard primary beam were used the ratios of I_{150} to I_{90} and of I_{40} to I_{90} (where I_a is the intensity of the scattered radiation in a direction making an angle of a degrees with the primary beam) both increased, but with very hard beams both decreased. The ratio of I_{150} to I_{90} was low and of I_{40} to I_{90} was high for the hard portions of the secondary beam. The amount of the forward radiation was always considerably greater than the radiation sent in a direction opposite to that of the beam. The results, though apparently contradictory, are very simply explained, since when the primary beam is soft the secondary beam consists of scattered radiation and an "extra" radiation which is softer than the primary. The proportion of extra radiation on the forward direction is very much greater than in the other direction. When the primary beam is hard the secondary beam consists of scattered radiation, a larger proportion of "extra" radiation than when the beam was soft, and hard, fluorescent carbon radiation. Confirmation of these views was obtained by a study of the relative absorbabilities of the primary and secondary beams.—*Philos. Magazine,* November, 1912.

Delta Rays Produced by Beta Rays.—N. CAMPBELL.—An account of an experimental investigation. One of the particular results is that the delta rays excited by beta rays are precisely similar to those excited by alpha rays. The properties of the delta rays are a function neither of the properties of the ionizing rays nor of the material which they ionize; they are a function of the properties of some mechanism which is concerned in all ionization.—*Philos. Magazine,* November, 1912.

Thermo-Electricity.—O. W. RICHARDSON.—A mathematical paper on the electronic theory of thermo-electricity

and thermionic effects, replying to some criticisms by Bohr and Wilson on some points in the author's theory.—*Philos. Magazine,* November, 1912.

Magnetic Rays.—A. Righi.—A paper on magnetic rays in different gases with reference to the results of a recent investigation by More and Rieman.—*Philos. Magazine,* November, 1912.

Mutual Inductance.—H. Nagaoka.—A note on a (British) Physical Society paper in which methods are given for the rapid calculation of the mutual inductance of two coaxial circular currents.—London *Electrician,* Nov. 8, 1912.

Units, Measurements and Instruments.

Moving-Coil Ohmmeter.—A note on a recent British patent (No. 22,740, Oct. 31, 1912) of J. W. Record. The current and pressure coils are mounted one above the other on the same axis. Each is provided with a separate magnet; the pole pieces are adjustable. Only the current coil embraces the iron core (as in the ordinary d'Arsonval galvanometer). The pressure coil, which may be wound in a magnetic or non-magnetic frame, or may be inclosed in a metallic sheath, is preferably of elongated form. By inserting a resistor of adjustable resistance in circuit with the pressure coil the control can be regulated at will. Two pressure coils astatically arranged may be employed so as to reduce the control to a minimum. It is claimed that this construction enables a very long scale to be obtained, and the instrument is very light.—London *Elec. Eng'ing,* Nov. 7, 1912.

Power-Factor Indicators.—A note on a recent British patent (No. 193, Oct. 31, 1912) of the British Thomson-Houston Company, Ltd., and the General Electric Company of this country. Two relatively movable elements, each consisting of two or more relatively displaced windings and phase-splitting devices, so as to produce in each element a rotating magnetic field, are provided. In one type the stationary element may be formed of two similar coils displaced 90 deg., connected in parallel with series impedances of different time constants. The movable element also consists of two movable coils with different impedances. The moving coils are connected in shunt through a non-inductive resistor. Changes of frequency do not affect the apparatus, but a change in the power-factor alters the relation of the currents in the fixed and moving coils, so that the latter rotate to a new position.—London *Elec. Eng'ing,* Nov. 7, 1912.

Telegraphy, Telephony and Signals.

Automatic Exchange Telephone Systems.—G. H. Green.—The first part of an illustrated article in which early suggestions for automatic telephony are referred to briefly and the fundamental principles underlying modern systems are then described more fully. A detailed description is given of the circuits of the "three-wire" and "two-wire" Strowger systems, and reference is made to some features of interest in the Epsom and G. P. O. exchanges recently opened.—London *Electrician,* Nov. 8, 1912.

Correct Time.—R. M. Hook.—A paper read before the (British) Institution of Post Office Electrical Engineers on methods of transmitting time signals from the main solar clock at Greenwich observatory to the central telegraph office in London and from there to sub-chronopher stations. Several methods for the physical correction of clocks are described.—London *Elec. Review,* Nov. 1, 1912.

Miscellaneous.

Association of Swiss Central Stations.—Dettmar.—An account of the general meetings of the Association of Swiss Central Stations and the Swiss Electrical Society held in Zurich from Oct. 28 to 30, 1912. Ringwald read a paper on energy rate problems and described a rate introduced by him with low prices in summer and higher prices in winter in order to get a uniform load during the year. He was against flat rates for large consumers and insisted that flat rates should be allowed only for small consumers. In this respect Wyssling and Wikender agreed with him. The latter spoke of the introduction of the flat rate for small consumers in many German stations and the successful results thereby obtained. Wille read a paper on the revision of the Swiss factory law and Wagner a paper on advertising propaganda for a more extended use of electricity. He thinks that the independent wiring contractor is the best salesman for the central station and should be helped along as much as possible. The committee on standardization of fuses and conductors expressed its intention to co-operate as much as possible with the German Association of Electrical Engineers. A report of the committee on protective devices against dangerous high voltages was read by Ringwald, who stated that the use of condensers is increasing in Switzerland and that they are quite successful. Ringwald said he considered it to be best to protect the station, the terminal points and some main points of the network, but not every branch. The branches are protected largely and with good success simply by choking coils. He thought that very good insulation of machines and transformers was more effective than the installation of protective devices against dangerously high voltages. Several excursions were made to power plants and substations and to the Oerlikon works.—*Elek. Zeit.,* Oct. 24, 1912.

Book Reviews

Sull' Applicazione dei Parafulmini alle Officine ed Edifizi. By Pasquale Viscidi. Rome: Stabilimento Tipo-Litografico del Genio Civile. 52 pages, 12 illus.

A short treatise presenting the theory of two types of lightning arrester employed principally for the protection of buildings. These are known as the "Franklin point" and the "Faraday cage." The construction of such arresters is thoroughly discussed and a series of practical conclusions is reached for guidance in making installations.

Small Water Supplies. By F. Noel Taylor. New York: The D. Van Nostrand Company. 162 pages, 126 illus. Price, $2.

A practical treatise on the sources, storage and distribution of water for domestic uses in small villages, farms and estates. There are chapters on the properties of water and sources of supply, wells and well sinking, flow of water in channels and pipes, pumping, and storage and distribution. It is written throughout in a simple, direct style and covers its field.

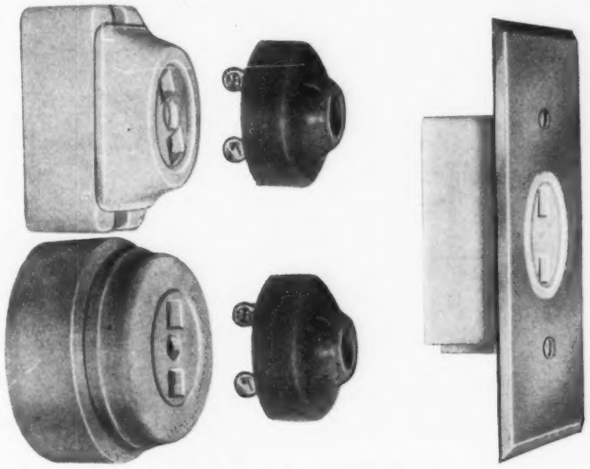
Magnetism and Electricity. By E. E. Brooks and A. W. Poyser. New York: Longmans, Green & Company. 624 pages, 413 illus. Price, $2.

An elementary textbook for electrical engineering students, covering the general field of electrical science and intended as preparatory for specialized courses either in pure science or electrical engineering. The volume was written primarily to replace Poyser's "Advanced Magnetism and Electricity," originally published in 1892. The authors treat the subject under three grand divisions—electrostatics, magnetism and voltaic electricity, covering the ground in a manner suited for advanced courses in preparatory schools or elementary courses in colleges or technical schools. In particular the authors had in mind the entrance requirements of English universities and the examinations held by the British Board of Education, and at the end of nearly all of the thirty-five chapters they give a series of questions taken from typical examination papers of the universities and the board. The calculus is not employed throughout the book, except in the appendix chapter on transient and oscillatory currents. Considered from the standpoint of the field covered and the class of students it is prepared for, this textbook seems very satisfactory.

New Apparatus and Appliances

ATTACHMENT-PLUG RECEPTACLES.

When using electric-heating and small motor-driven devices it is not always convenient or desirable to feed them from a fixture socket. For this reason, the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has designed and placed on the market a set of attachment plug receptacles to fit in with its line of porcelain and composition attachment plugs. The caps and the plugs are interchangeable in all styles so that any plug can be used with any receptacle. A round-base receptacle is designed for use with concealed wiring, while the rectangular-base type is particularly suited for use with molding work.



Attachment-Plug Receptacles.

SMALL ELECTRIC METERS FOR AUTOMOBILES.

The meter illustrated herewith is only 3 in. in diameter, and is designed for use on automobiles, motorboats, yachts and small switchboard panels. It operates on the D'Arsonval principle, having a moving coil and a permanent magnet, which renders it free from residual errors. Its high torque and high damping characteristics make it suitable for automobiles, as the pointer does not vibrate.

Small Electric Meter.

The complete movement is mounted as a unit and may be removed for repairs, for which purpose the rim and glass cover are taken off and two screws on the side of the movement removed, whereupon the entire moving element and bearings can be lifted out as a unit and can be replaced in exact position. The meter may be repaired without disturbing the alignment of the magnetic circuit. Owing to the use of an aluminum pointer, a light counterweight is allowed, resulting in a light-weight movement and small wear on the pivot jewels. The full length of the pointer shows on the dial, thus making the meters easy to read. The construction is such that the meter will withstand the shocks to which it will be subjected without losing its accuracy.

The scale is made of etched metal and subtends an arc of 90 deg., giving large open divisions. The zero of the ammeter is placed in the center of the scale, so as to indicate current in either direction. On the voltmeter scales the zero point is omitted in order to obtain wide divisions and greater accuracy around the 5-volt point, which is the normal cell voltage for automobiles.

A flush meter is made for mounting on dashboards 0.25 in. thick or less and will then project in front of the board by less than 0.25 in.

These meters have been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

IMPROVED SQUIRREL-CAGE ROTORS.

The squirrel-cage induction motor has long been recognized as a most substantial and reliable apparatus. However, one detail of construction that has caused more or less trouble is the joint between the rotor bars and the end rings. Various forms of screwed joints, riveted joints and soldered joints have been employed with more or less success. In order to eliminate excessive heating at these joints Fairbanks, Morse & Company, Chicago, Ill., have employed the method of casting on the end-rings after the rotor bars are assembled. It is stated that by this process a perfect fusion of every bar with the metal of the end-ring is secured and a perfectly solid "cage" is produced. After casting, the rings are finished as shown in Fig. 2 and a deep groove is cut into each ring down to the union of the bars and the rings, so that the integrity of each weld can be inspected.

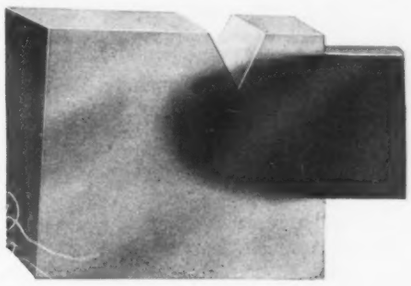


Fig. 1—Rotor Bar.

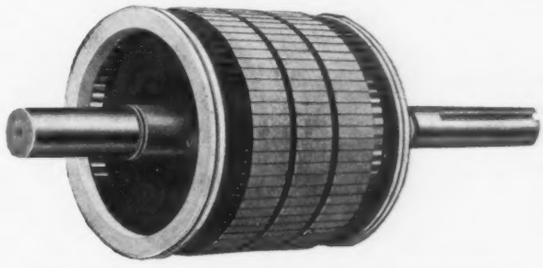
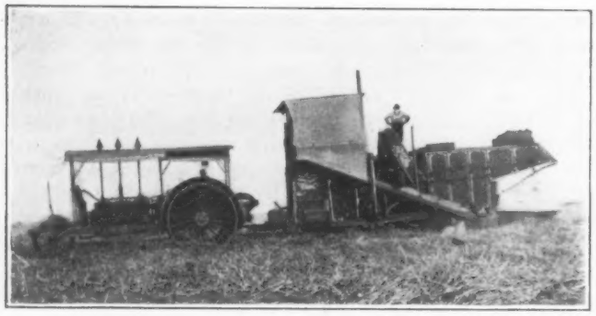


Fig. 2—Complete Rotor with Cast-On End-Rings.

GAS-ELECTRIC HARVESTING MACHINE.

At Elmhurst, Cal., a novel adaptation of electricity by the use of a gas-electric harvesting machine has been seen in the fields for some time. This harvesting equipment consists of an 80-hp, six-cylinder gasoline tractor hauling a motor-driven harvester. On the rear of the traction engine



Gas-Electric Harvesting Machine.

is placed a 20-kw direct-current generator driven by a shaft extending forward and belted to the flywheel of the engine. This generator is totally inclosed to exclude dust and dirt.

Instead of a belt or rope drive for the harvester it is operated by a 25-hp, 230-volt motor directly coupled to the thrashing cylinder. This motor is also inclosed and has forced ventilation through a pipe extending above the machine. It is claimed that this gas-electric harvesting equipment will head, thrash, reclean and sack the grain for a total cost of 80 cents per acre, against $3.50 per acre by the old method. It will harvest approximately 2200 bushels per day of ten hours. The electric equipment was furnished by the General Electric Company, Schenectady, N. Y.

PUSH-BUTTON SURFACE SWITCH.

A circular-base surface switch has recently been added by the Cutler-Hammer Manufacturing Company, Milwaukee, to its line of switches designed particularly for molding work. This switch is made in two styles, one having a label holder and one having a plain cap without label holder. Where several switches are located at one place the former type of switch is adopted, as each may carry a label indicating the circuits or lamps controlled. The depth of this new switch is only 1.75 in. and the diameter of the cover or cap, which is of polished nickel,

Push-Button Surface Switch.

is 1⅞ in. The circular porcelain base is like those of other surface switches, but the back is hollowed out for circular loom or concealed wiring, or for surface use.

One of the particular features of this switch resides in the absence of a protruding button, which may be broken off or by turning the wrong way be disconnected and lost. The mechanism of the switch is so arranged as to eliminate the rotating button and substitute therefor the straight push-bar, which cannot be removed and cannot be accidentally knocked off so easily as can the button. The push-bar is provided with a light button at one end and a black button at the other for indicating whether the switch is "on" or "off."

RECENT ELECTRICAL EQUIPMENT FOR X-RAY WORK.

X-ray "snap-shots" one-tenth of a second in duration now suffice to photograph the thickest parts of the human body with an accuracy of definition far surpassing the best work done a few years ago when exposures of an hour or so were necessary. This remarkable advance in practical X-ray manipulation can be traced principally to the improvement of the electrical equipment for supplying high-tension direct current to the Crookes tube.

Currents of 75 to 100 milliamperes at well above 100,000 volts are now used regularly in certain types of apparatus, and the modern X-ray tubes with their huge copper-inclosed tantalum anodes present a striking contrast to the flimsy equipment employed when the art was first developed. At

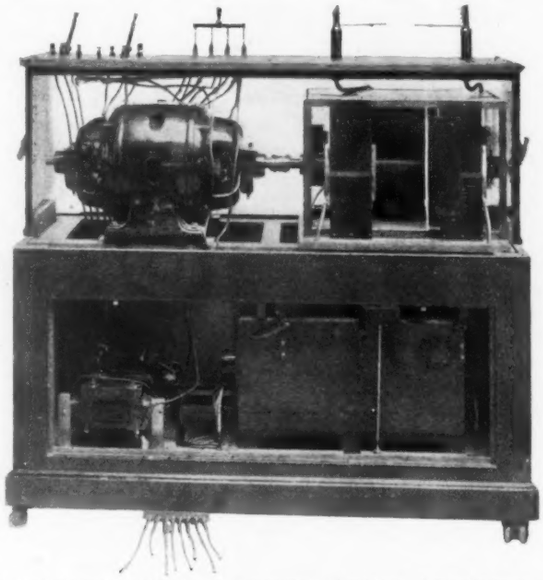


Fig. 1—Cabinet with Cover Removed, Showing Transformer and Synchronous Switch.

the enormous intensities at which modern tubes are worked the bombardment of cathode particles where focused on the anode develops a display of energy almost simulating the electric arc in brilliancy. Despite the elaborate provisions for conveying heat away by means of the copper jackets, etc., the normal current taken by one of these tubes would actually destroy it if applied continuously for even three seconds.

The history of the electrical apparatus for supplying energy to the tubes is as interesting and varied as that of recent arc illuminants. First the static machine was employed, but the current obtainable was very small and long exposures were necessary. Certain types of high-tension coils were also used about this time, but, while more powerful, these introduced objectionable "inverse" currents, detracting from the intensity of the rays developed by the properly poled currents. After this experimentation with alternating-current apparatus, the tide reverted to direct current. Some kind of rectifying apparatus, such as a chemical or rotary converter, was employed to produce unidirectional low-tension current, and this was then interrupted by a mechanical or electrolytic device in connection with a coil. Unidirectional current at the tube is neces-

sary for best results, and whatever inverse current was present in the secondary output of the coil was then eliminated by special "valve tubes" inserted in the Crookes-tube circuit.

The most recent and very logical development, however, has been the production, first, of high-tension alternating current of necessary voltage, by means of a commercial-

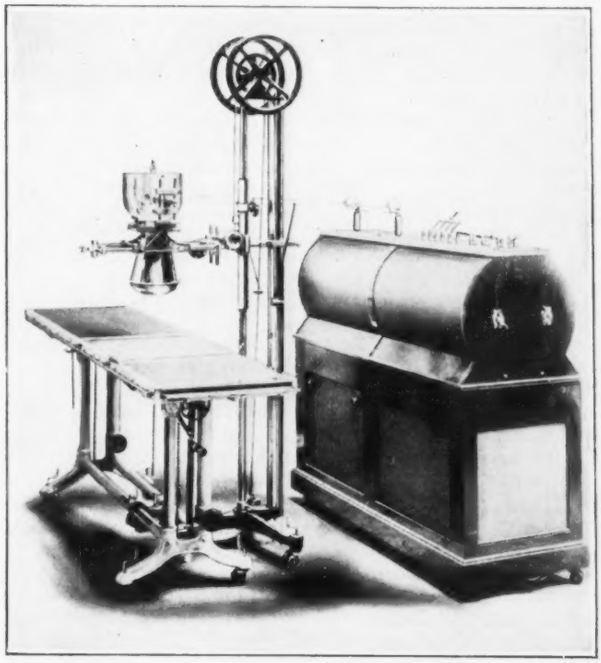


Fig. 2—Cabinet, Tube Stand and Photographic Table.

frequency transformer or coil. This high-tension current is then rectified by a synchronously driven commutator, the unidirectional output being led directly to the X-ray tube. Fig. 1 shows an equipment of this kind as furnished by one of the leading manufacturers of X-ray apparatus, the Kelley-Koett Company, Covington, Ky. The 4-kw transformer, stepping up from 220 volts to the high-tension pressure, is seen in the lower compartment. Above at the left is a Wagner 1-kw rotary converter whose shaft is extended to drive at synchronous speed the rectifying contact arms which sweep past the fixed segments. For X-ray purposes the converter is here utilized only as a synchronous motor, but it is also useful for supplying direct current for other purposes about the physician's office. Where only direct-current supply is available, a larger rotary is provided and arranged to be run inverted, producing alternating current for the transformer and also driving the rectifying commutator at synchronous speeds.

With the large high-voltage unidirectional output of a machine like this, currents of 100 milliamperes and even higher can be delivered to the tube, producing cathode rays and X-rays on a scale such that only a momentary closure of the switch is necessary to make a picture through the thickest part of the body. As the current flow is entirely in one direction, the troublesome inverse is avoided and valve-tubes or other devices are not needed. For making chest skiagraphs 0.1 second suffices, while for abdominal pictures 0.25 second may be required. Lesser sections demand correspondingly shorter exposure. The spectacle presented by a modern tube passing 100 milliampers is far different from the pale illumination which lighted up the older tubes operated by a static machine. The air about the terminals crackles to the point of break-down, the whole tube is suffused with a bright green glow, and on the anode terminal at the focal point of the cathode rays there scintillates a brilliant spot that resembles in quality and intensity an electric arc between carbon electrodes. At such intensities, of course, the transformer switch can be closed only momentarily; for three seconds' continuous operation of the tube would destroy it. And these tubes cost $50 each.

Fig. 2 shows some of the convenient accessories developed for modern X-ray examination. Photography is now depended upon altogether in making examinations, the fluoroscope and direct vision being no longer used for serious work. The tube is carried in a lead-glass shield on the adjustable stand, connection being made to the supply termina's through retriever cords. A spark-gap bridges the tube to prevent overloading. The photographic plate is carried on a slide beneath the table top, provision being made for quickly changing plates, meanwhile protecting the others against exposure. For stereoscopic pictures two negatives are made, the tube source being moved a predetermined distance after the first picture has been taken. When examined in properly arranged illuminators, the bones, organs, etc., are all shown in distinct perspective. Based upon the same principle, ingenious and accurate graphical methods of locating foreign bodies have been devised. One operator has located steel chips in the eye with an error of less than 1 mm in all of a dozen cases. The X-ray has an admitted field in the direct treatment of skin diseases. With modern equipment and short exposures the danger of serious burns, so prevalent with the long exposures of weak sources, is now almost eradicated.

ELECTRIC STOVE AND FIRELESS COOKER.

In the description of the Quad fireless cooker which appeared in these columns in our issue of Nov. 9 the inference was left that special wiring would be required for the device. This is not the case, as the cooker can be fed with energy from an ordinary lamp socket. According to the manufacturer, the A. L. Sykes Manufacturing Company, Cincinnati, Ohio, the maximum expenditure is 600 watts. The plates are designed for voltages ranging from 95 to 105, 105 to 115, 115 to 125, etc., up to 250 volts.

INSULATING SHOES.

The St. Helen's Cable & Rubber Company, Ltd., Warrington, England, has brought out insulating shoes comprising a galosh of ordinary type, with cross rubber ribs vulcanized upon the sole, the heel and the instep, as shown in the accompanying illustrations. The ribs do not add materially to the weight of the shoe, but increase consider-

Insulating Shoes.

ably the safety of the user, since the amount of wear is distinctly visible on the raised surfaces of the ribs, whereas it is somewhat difficult to tell how far wear has affected a flat sole, especially as it takes place inside the shoe as well as outside the shoe. An adjustable ankle strap enables the shoe to be worn on various sizes of foot, over the shoe, of course, with comfort.

Industrial and Financial News

ELECTRICAL TRADE CONDITIONS.

TAKEN as a whole, the replies received from electrical manufacturers in response to circular letters asking for data on conditions in the electrical manufacturing industry in 1912 as compared with those in 1911 show that the year's results thus far have been highly satisfactory, and that a widespread degree of optimism prevails as to the future.

Reports of increases of from 20 per cent to 50 per cent in volume of business are exceedingly numerous, while in some instances, notably in the electric-vehicle field, increases of as much as 300 per cent over the 1911 total are shown. The general tone of the replies shows, however, that profits have not increased in direct proportion to the volume of sales. A great many reasons for increase in volume of business are given, among which natural growth, decrease of trust investigations, improvement in design and expansion of all lines of trade appear most frequently.

Increase in cost of raw material and price-cutting competition, accompanied by smaller margin of profit and requiring an increase in volume to clear the same profit as in former years, are among the chief reasons stated as underlying the smaller percentage of profit reported.

As regards the outlook, the general feeling, as noted above, appears to be very cheerful, and no great changes in price are looked for. From our replies, uncertainty as to the extent of tariff legislation by the next administration is regarded as the principal drawback to future expansion. In substantiation of the confidence expressed in the future, it will be noted that practically all of the manufacturing companies quoted state that they have recently made or are about to make extensive additions to their manufacturing facilities.

The list of questions sent out is as follows: (1) How has your 1912 business compared in volume and profits with that in 1911? (2) To what do you attribute these increases or decreases? (3) What is your opinion on the price and business outlook in your field in 1913? (4) What do you consider the greatest drawback to expansion in your field and what remedy do you suggest? (5) Are you contemplating any extensions to your works, any new financing, the establishment of any new branches, or the manufacture of any new products?

We wish to take this opportunity to express to the many manufacturers who have responded to our inquiry our appreciation of the courtesy which they have rendered us.

A partial list of responses appears below. Others will appear in a subsequent issue. Where names are omitted it is by request of the company sending the information.

ELECTRIC VEHICLES: (a) Baker Motor Vehicle Company.—Our pleasure-car sales alone have made an increase of 123 per cent in the past year. We attribute this to better and more extensive advertising, introduction of new models, bigger and better organization and satisfied customers. No price changes are anticipated. Boom year is expected in 1913. Lack of appreciation of the economy, reliability and efficiency of electric vehicles is the greatest drawback. This must be overcome by persistent educational efforts. We are contemplating a 30 per cent increase in factory buildings.

(b) One of the Largest Manufacturers of Electric Commercial Vehicles.—This year's business shows a little better than the usual 50 per cent annual increase. We have done the greatest small-wagon business in our history, as against two years ago, when 40 per cent of our sales were 5-ton trucks. This is due to our policy of selling vehicles only where adapted to the work of customers and to co-operation with the latter. It is too early to forecast next year, but we regard general conditions optimistically. Competition of inexperienced manufacturers who cut prices to get quick distribution is regarded as the greatest handicap. The situation will clarify itself when business concerns buy motor trucks on an investment basis. We shall triple our facilities in 1913.

(c) Our 1912 business shows an increase of 300 per cent over that of 1911. This is due to increasing demand for efficient and dependable motor vehicles, operative at a saving over horse-drawn methods of transportation. Firm prices and at least 100 per cent increase in business are expected next year.

STORAGE BATTERIES: (a) A Leading Manufacturer.—Our business in the first nine months of 1912 shows an increase over the corresponding period of 1911 of over 60 per cent. This is attributed to the great growth of the electric-vehicle industry. Business outlook for 1913 is exceedingly bright, and orders we are now receiving are taxing our fullest capacity. We are engaged at present in building a new six-story factory and a new four-story plating building, which when completed will more than triple our output.

(b) Willard Storage Battery Company.—Our 1912 business shows a decided increase in volume with a proportionate increase in profit, due to development along various lines, involving a demand for our product in practically new fields. Outlook for business next year is excellent, with no need for changes in existing prices. We have just doubled our manufacturing facilities.

WIRE: (a) Rome Wire Company.—Business this year has been considerably larger than that of 1911, and, so far as we can judge at present, has been of a satisfactory nature as to net profits. This we attribute to general business activity in all lines. We look for a very large output during 1913, but do not look for any appreciable changes in the price situation. While prices of copper have advanced during the past year and will probably remain at a high level during 1913, the prices of finished products have been very close. We know of no drawback to future expansion. We deal with manufacturers and jobbers whose business should continue to grow for years to come, owing to the general introduction of electrical apparatus. Will probably build an extension next year.

(b) Electric Cable Company.—This year's business shows a material and most satisfactory increase, due to natural and heathy growth of the whole electrical industry, great crops and a general feeling of optimism throughout the business world. As regards the outlook, when all of the factories accumulate unfilled orders prices will naturally advance. With the exception of ill-advised tariff reductions, nothing now appears which could affect business in 1913. We see no serious drawback of any kind, as the production of light, heat and power electrically is growing rapidly. We are now erecting at Bridgeport a new factory which will double our production.

(c) National India Rubber Company.—Our 1912 business was the largest in our history. We attribute this to better business conditions in all lines of trade. Are contemplating general expansion in all our lines.

(d) American Insulating Machinery Company.—This year's business shows at least a 25 per cent increase, which we attribute to renewed confidence in business circles throughout the country. The business outlook is good and prices ought to be better. We cannot see any drawback at present. We now have the greatest force employed since the company was organized and have business ahead for six months. Additions to equipment are contemplated.

(e) From Other Wire Companies.—Our rubber-covered wire business has greatly increased over that in 1911—possibly by 30 per cent. We attribute this to generally better conditions in the electrical business. Prices for rubber-covered wire in 1913 will remain practically the same as at present, subject, of course, to changes in the copper market. Business looks good with us for at least the first six months of the year. We are running two shifts of twelve hours each in our rubber-covered wire department for the first time in the history of our company, which was established in 1890. We are now considering an increase in our capital stock, effective Jan. 1, 1913.

(f) This year's showing is considerably ahead of last year's. We regard this as due to a better feeling generally, and to good crops and low stocks. The outlook for next year appears to be very good. Tariff agitation, creating uncertainty, seems to be the greatest drawback. We are not contemplating any extensions.

MOTORS: (a) Richmond Electric Company.—Our business has increased over 40 per cent and our profits over 30 per cent, due to increased demand for induction motors and to changing over of central stations from direct current to alternating current. Lots of business in sight for 1913. Prices should be higher, as both labor and material are costing more, but we do not believe that prices will be raised. The greatest drawback to expansion seems to be from foolish, cut-throat competition; that is, the attitude on the part of some manufacturers to take business at any price. We have let contracts for extensions that will more than double our floor space. We are increasing our line of polyphase motors and expect to build them as large as 250 hp, with corresponding sizes in alternators.

(b) Triumph Electric Company.—Our business shows an increase of 57 per cent, the result of development of additional apparatus and increased advertising. Lots of business is in sight for 1913, but not a very large margin of profits. Our brass foundry has been increased in size three times within the past eighteen months, and additional extensions are contemplated. We propose developing a line of fractional horse-power motors and single-phase motors in the future.

From Other Motor Manufacturers.—(c) This year's business shows an increase of 10 per cent, which is regarded as due to natural growth. The outlook is good. We expect to enlarge our plant.

(d) The volume of our business increased about 25 per cent this year. Attributed to general betterment of conditions in all industries. We believe that business will be good for at least the first six months of next year. After that conditions will depend upon how radical the tariff measures of the new administration become. We consider that the monopolistic tendencies of some of the larger companies are the greatest drawback in our field.

(e) Our business showed a substantial increase in volume, and we expect fair increase in profits. We ascribe this partly to general improvement in the whole business situation and partly to the addition of further lines of manufacture. We look for the present situation to remain substantially as it is until a definite line can be had by the general public on the probable results of tariff changes at the next session of Congress. We are planning to increase our capital.

(f) Our business this year was about twice that in 1911. This is due to natural expansion. We regard both the price and business outlook as very good. Monopolistic tendencies seem to be the greatest drawback. We have just increased our facilities about 30 per cent and are adding a new line of arc welding machinery and voltage regulators.

DIRECT-CONNECTED UNITS: From a Well-Known Manufacturer.—Our 1912 and 1911 business were about the same. We regard the prospects as having improved. The reciprocating business has been hurt by the steam turbine. We are now making both kinds of units.

SECOND-HAND MACHINERY: (a) Messrs. Duzets & Son.—Business with us for the year 1912 has been much greater than that in 1911, and, in fact, this was one of the best years we have had since we have been in business. We attribute this to more extensive advertising and to the generally better financial conditions throughout the country. We honestly believe that 1913 will show up considerably better than 1912, as trade conditions are growing better every day. Disturbance of the large business interests has been the greatest drawback. Regulation of them should be done gradually, not spasmodically.

(b) This has been the largest year in our history for volume of sales. Our profits have been smaller than usual, for two reasons: first, the high cost of labor; second, our tonnage is constantly increasing faster than the value of our shipments. In other words, second-hand electrical machinery is continually getting lower in price, so that each year we have to handle a much greater tonnage to clear the same amount of money. We think our increase in business is just a normal one and that the demand for 1913 will be fully as large, and even larger.

STEAM TURBINES: Our business in 1912, in comparison with 1911, is about 35 per cent greater. We believe that the business outlook in our field for 1913 will be much better than it was this year. We are not contemplating any additions to our works.

OIL ENGINES: Remington Oil Engine Company.—Both volume of business and profits increased about 30 per cent this year. That we have been pushing our business harder is one reason for this, and another is that users of power are beginning to realize the economy of oil engines. Conditions for next year appear to be very favorable. Lack of knowledge of the oil engine on the part of the public, and the statements of some manufacturers of oil engines that the latter will operate with any kind of oil are the greatest drawbacks in our line. We are now building some new types of engine and also contemplate building larger sizes.

TRANSFORMERS: An increase of about 30 per cent is shown by this year's business. This was due to generally good trade conditions and to the extensive construction carried on by central-station companies. Business looks very good for 1913. Prices for transformers, comparatively speaking, are too low. The greatest drawback in our field is the inability of the supply-house salesman to compete with the technical experts such as those which two or three of the largest manufacturers maintain. The remedy points to direct representation, which will eventually eliminate the jobber. Are contemplating additions which will double our output.

INCANDESCENT BULBS, ARC GLOBES, TUBING: (No comparison given.) Sound business conditions existed during the year, due to enormous crops and the starved condition of the railroads, our largest consumers. The future must depend upon the attitude of the new administration. A strong fight should be made against unwarranted tariff reductions.

TUNGSTEN LAMPS: Although this has been our first year, our business has grown steadily. Generally sound business conditions, our own activity and advertising have been the causes of this. We think the outook is very good. Uncertainty as to tariff legislation and settlement of patent litigation are the most serious drawbacks just now. We are planning additions.

CARBON BRUSHES: (a) Our business showed a gain of about 10 per cent this year, which we attribute to natural conditions. We regard the outlook for business in 1913 as substantially the same as it was this year. We expect to build an addition in the spring.

(b) While our business is rather young, our 1912 total was vastly in excess of that in 1911. The outlook seems to be very good.

(c) Pure Carbon Company.—(No answer given to question 1.) Prices will continue about the same as this year, and business, we think, will improve. The greatest drawback is the lack of co-operation between carbon manufacturers. We suggest the standardizing of carbon products. We are planning a $25,000 addition to our factory.

HEATING APPLIANCES: (a) The volume of our business increased about 5 per cent this year, and the profits by about the same amount. This is due to increased demand for electric heating devices. The business outlook is the "best ever." Price maintenance should be better, but we don't expect that it will be. Non-standardization of business methods of central-station companies selling electric-heating devices and their unfair price competition with dealers are the greatest drawbacks. Central stations should agree with dealers in their territories to sell electric appliances at, say, one-third above cost, at least.

(b) Our business thus far in 1912 shows a very material increase over that in 1911. This is probably due to the broader public interest taken in electrical development as well as to the natural growth we have enjoyed for many years. Prices will remain about the same. The greatest drawback is the inability to keep abreast of the demand for new applications and for further application of devices already on the market.

CONTROLLERS, CIRCUIT BREAKERS, SWITCHES, RHEOSTATS, PANEL BOARDS, ETC.: (a) This year's business has been satisfactory. There has been a natural increase, due to better engineering methods and generally sound business conditions. We think the outlook is somewhat uncertain. Better engineering advice for the consumer would assist expansion in our field.

(b) A very material increase in volume over 1911, but a decrease in the percentage of profit, due to raising of prices for raw material. We attribute the foregoing to general expansion of the electrical trade, to holding old customers and getting new ones. It looks to us as if the business outlook for 1913 ought to be first-rate. We are decidedly optimistic. Prices ought to be raised in some lines as the margin of profit is altogether too low. This, we believe, is the consensus of opinion of manufacturers in our line.

(c) Our trade has increased in a very satisfactory manner, due to the quality of our goods and our ability to make prompt shipments. We anticipate a material increase in business next year.

(d) We have had an increase of about 50 per cent over 1911 business, due to natural growth. The business outlook is good as far as quality is concerned, but the price outlook is not so satisfactory, on account of cheap competition. The latter is the greatest drawback in our line, as we have certain competitors who show a tendency to cut prices even at the sacrifice of quality. We doubled our factory capacity this year and will probably, from present indications, be obliged to make still further increase in floor space.

RAWHIDE GEARS AND PINIONS: (a) The volume of our business increased over 50 per cent, but the profits were not in proportion. The increase in business was due to general conditions and the decrease in profits to extreme high prices for raw materials. Prices are bound to advance, and business next year will be good. Have just practically doubled our capacity.

(b) Business with us was 33 1-3 per cent greater this year than last, and profits will show some increase. This is due to better business conditions, and therefore to greater demand. The year 1913 looks like a record year to us. We are just completing a new four-story building with 50,000 sq. ft. of floor space, and are installing much additional machinery to take care of the big increase in business which we expect in the next two years.

WOODEN POLES: Naugle Pole & Tie Company.—Our business was 25 per cent greater than last year's, owing to better prices and to improvement in business confidence, while prices have followed the laws of supply and demand. The outlook seems to be very bright. Our greatest drawback is limited supply. We are now going into the Western cedar-pole business, because the demand this year has been for long poles, and the supply of Michigan cedar long poles has been almost exhausted.

STEEL POLES AND LINE MATERIAL: Franklin Steel Company.—Our business practically doubled this year in volume, with a substantial increase in the percentage of profit. This has been due generally to better feeling with regard to the likelihood of cessation of political persecution of corporations, and specifically to advertising. Our prospects for 1913 are indicative of a still larger volume and further price advance. As to drawbacks, we think tariff tinkering with finished materials the greatest. We believe that any radical revisions should be confined to raw materials or products upon which the labor cost is comparatively small as compared with the material cost, and that trade associations should present facts along these lines to Congressmen. We are doubling the capacity of our assembling rooms and erecting another large building for new work.

ELECTRIC WASHERS: The Maytag Company.—This year's sales show an increase of 200 per cent. Prices will not change, while the outlook appears to be even better than in the past. Lack of co-operation from central-station companies is our greatest handicap.

MEASURING INSTRUMENTS: (a) Our 1912 business shows an increase of about 50 per cent over that in 1911, which we attribute to the fact that we are a growing company rather than to any general business condition. The bulk of our business is done with the large public service corporations. If the larger interests are willing to spend their money and do nothing to unsettle confidence, there is no reason why we should not increase in the same proportion next year. We are now arranging for a new shop which will give us three times the capacity of our present one. We are expecting to put out some new designs which were withheld this year as we were continually from thirty to sixty days behind on our orders.

(b) An increase of about 20 per cent in volume. Much improvement in profits owing to increase in proportions of business in specialties in which there are larger margins, and also to the fact of our product having become better known.

(c) Keystone Electrical Instrument Company.—Our 1912 business increased about 50 per cent over the previous year. Improvements in our product and the recognition of these improvements by the trade were the causes of this. We are most optimistic as to the future. We fear that the greatest drawback is the unjust division of the markets by large electrical interests. We will triple our manufacturing space after Jan. 1.

(d) Esterline Company.—This year's showing will be ten times that in 1911. We attribute this to new lines, general improvement in business conditions, to better sales organization and to our product having become more widely known. We think the outlook is excellent and expect to do even better next year. Our only drawback has been to develop our organization in step with our increasing business. Labor is growing more scarce all the time. We trebled our floor space in 1912 and have already taken steps to double it in 1913, as we had to have a considerable part of our work done outside this year.

(e) This year's business has been greater than last year's, due to improvement in general trade conditions, especially since summer. Next year looks even better. We are planning extensions.

(f) Atwater-Kent Manufacturing Works.—Improvement in both volume and profits, due to the merits of our products. The outlook, we think, is very favorable. We have just moved into our new plant, which is more than double the size of the one vacated.

(g) Duncan Electric Manufacturing Company.—Our business and profits increased approximately 71 per cent, due to general business prosperity. As regards the outlook, if they monkey with the tariff, they are simply poking a stick into the business beehive. As to drawbacks, the greatest is furnished by small competitors entering the market and cutting prices with inferior apparatus and then going into bankruptcy. We have just let a contract for a new addition to our factory for an additional 25,000 sq. ft. of floor space.

INDUSTRIAL AND FINANCIAL NOTES.

Says Our Utility Securities Are Regarded Highly Abroad.—Henry L. Doherty, upon his return from abroad on Nov. 22, stated that he had found satisfactory financial conditions in London. One element of the situation which impressed him to a considerable extent was the strong tendency which was apparent abroad toward investment in American securities. He attributed this largely to the Balkan war and the Mexican disorders. Large amounts of foreign capital have been invested in Mexican and South American projects in recent years, Mr. Doherty pointed out, but in view of the various dissensions that have arisen in Mexico, Turkey and elsewhere London financial interests have given more thought to the merits of American securities. He expects to see a considerable growth in this sentiment and looks for a very heavy demand for American securities for investment within a reasonable time. Commenting further, he said, in part: "The investing public abroad is beginning to realize that it is not necessary to confine its investments to securities that yield a return of not more than 3 or 3½ per cent, in order that it may consider its money safely invested. For that reason the large insurance companies as well as prominent banking interests abroad are investing funds in securities of organizations located in a country which is free from all disturbances. I was agreeably surprised to find that the demand for public utilities securities in London and on the Continent is growing very

rapidly. On some of my other visits to London I found more or less skepticism with regard to the investment of foreign capital in public utilities of American organization. On this visit, however, I found that not only were the prominent banks in London greatly interested in public utility stocks and bonds, but the large insurance companies were also agreeably disposed toward the investment of funds in such securities." Mr. Doherty's trip abroad was in connection with the financing of the Utilities Improvement Company, formation of which was noted in these columns Oct. 19.

Substation Apparatus for Plant at Shelburne Falls, Mass.—Among recent large orders received by the Westinghouse Electric & Manufacturing Company for transmission apparatus is one from the Power Construction Company, Shelburne Falls, Mass., which covers the equipment of five substations to be operated by this company, and consists of the following apparatus: Nine 300-kw, 600-volt direct-current, three-phase, 60-cycle, self-starting rotary converters; two 2000-kw, 600-volt, six-phase, 60-cycle commutating-pole rotary converters; twelve 110-kva, 13,200 to rotary voltage, single-phase, 25-cycle transformers; six 700-kva, 13,200 to rotary voltage, 25-cycle air-blast transformers, and five complete substation switchboards. It will be noted that the transformers have a frequency of 25 cycles whereas the rotary converters have a frequency of 60 cycles. The transformers are designed for operation on both frequencies, but for the present will be operated on the higher frequency and will eventually be used on the lower frequency.

Are Installing More Station Equipment.—The Great Western Power Company, San Francisco, Cal., is adding to the equipment of its San Francisco station a new 5000-kva transformer and is installing in the Oakland stations twelve smaller transformers, six of 200-kva and six of 300-kva capacity. The East Creek Electric Light & Power Company, Inghams Mills, N. Y., is installing additional apparatus in its station at Inghams, consisting of a 2200-kva two-unit, two-bearing frequency changer set, a 25-kw motor-generator set, three 1250-kva transformers and a switchboard. C. D. Parker & Company, Palmer, Mass., are augmenting the equipment of their power stations by the installation of a number of transformers. In the lot are included four of 30-kva, nine of 100-kva, three of 300-kva and three of 1000-kva rating; also considerable switchboard material. All the apparatus mentioned above has been purchased from the General Electric Company.

Has Sold 50,000 Electric Laundry Machines.—The Hurley Machine Company of Chicago, celebrated during the week ended Nov. 23 the sale of 50,000 Thor electric home-laundry machines. This is a remarkable record, and the company believes that the Thor electric washing and ironing machine has done as much toward popularizing electricity in the household as any other electrically operated device. The first Thor electric home-laundry machine sold was purchased about four and a half years ago and is to-day in working order and apparently as good as ever. The Hurley Machine Company feels indebted to an appreciable degree to the central stations and electrical contractors of the country for their co-operation in the work that has made possible this placing of 50,000 motor-operated labor-saving devices in the homes of the country.

May Consolidate with Alabama Traction, Light & Power Company.—While no official statements have been made, it is believed that, through the recent sale of a large block of American Cities common stock by Bertron, Griscom & Company and associates at $47.50 a share, and the placing under option of another large amount at $65 a share, a change in control of that corporation will take place. The sale was made to foreign bankers, who, it is understood, are closely identified with the Alabama Traction, Light & Power Company, and it is this fact that has led to the belief in financial circles that a consolidation of these large interests will be effected. Details of the plans of the Alabama company appeared in these columns March 16, 1912. Data concerning the formation of the American Cities Company appeared in the issue of May 25, 1911.

Southern California Utilities to Issue Bonds.—The California Railroad Commission has approved the application of the Southern California Utilities to issue the $10,000,000 bonds to which reference was made in these columns June 29, 1912. As was noted Aug. 31, an English syndicate has already underwritten this issue, contingent upon the approval of the commission. The Ramona Power & Irrigation Company, the Lake Hemet Water Company, the Fairview Land & Water Company, the Hemet Town Water Company and the Hemet Land Company, will be purchased by the Southern California Utilities with the proceeds from the sale of these bonds, in connection with an irrigation and power project which that company will carry out in Riverside County, Cal.

Continental Gas & Electric Corporation Organized.—The firm of Abbot & Eaton, which was formed in Cleveland, Ohio, this fall to engage in engineering work and direct the operation of gas and electric companies, as was noted in these columns Sept. 21, 1912, has organized the Continental Gas & Electric Corporation under Delaware laws with a capitalization of $7,500,000 to erect and operate gas and electric plants. The new concern is backed by Cleveland capital. While no details of the company's plans have been announced, it is understood that it will take over and operate several public utilities in Ohio and neighboring states.

Pennsylvania Water & Power Voting Trust Expires.—The voting trust of the Pennsylvania Water & Power Company, which was created two years ago and under which the common stock of the corporation was deposited, has expired and the free stock is now being transferred through the Fidelity Trust Company, of Baltimore. The voting trust was formed on Feb. 7, 1910, and expired Oct. 31, 1912. It was composed of J. E. Aldred, president of the Pennsylvania Water & Power Company; William M. Barnum and C. E. F. Clarke.

Middle West Utilities Sells Bonds.—The Middle West Utilities Company has sold $3,000,000 5 per cent bonds, secured by a first and refunding mortgage of the Central Illinois Public Service Company, to N. W. Halsey & Company, of New York and Chicago.

NEW YORK METAL MARKET PRICES

	Nov. 19 Bid.	Nov. 19 Asked.	Nov. 25 Bid.	Nov. 25 Asked.
Copper:				
Standard, spot	17.20	17.50	17.05	.....
	£ s d		£ s d	
London, standard, spot	77 18 9		76 15 0	
Prime Lake	17.75		17.60 to 17.70	
Electrolytic	17.62½		17.50	
Casting	17.45		17.25 to 17.35	
Copper wire, base	19.00		19.00	
Lead	4.75		4.50	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.50		7.50	
Tin, spot	49.62½		49.25	
Aluminum:				
Prompt delivery	26.00 to 26.50		26.00 to 26.50	
Future	26.00		25.50 to 26.00	

OLD METALS

Heavy copper and wire	16.75	16.00
Brass, heavy	10.00	10.00
Brass, light	8.75	8.75
Lead, heavy	4.40	4.30
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN NOVEMBER

Total tons, week ending	Nov. 19, 8,657	Nov. 26, 12,987

INDUSTRIAL SECURITIES.

Security.	Capital Stock Listed.	Dividend. Per Cent.	Dividend. Period.	Quotation. Nov. 20	Quotation. Nov. 26
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	2⅞*	2⅞*
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	10*	10*
Amalgamated Copper	153,887,900	1	Q	85	84⅞
American Tel. & Tel.	334,712,300	2	Q	142⅞	142⅞
Crocker-Wheeler, c.	1,700,000	1½	Q	86*	85*
Crocker-Wheeler, pf.	500,000	1¾	Q	105*	105½*
Electric Storage Battery, c.	16,074,425	.....	.....	54¼	54¼
General Electric	77,726,700	2	Q	182*	184
Mackay Cos., c.	41,380,400	1½	Q	85⅜*	85½*
Mackay Cos., pf.	50,000,000	1	Q	68	68*
Western Union Tel.	79,943,400	¾	Q	78*	79⅛
Westinghouse, E. & M., c.	31,685,300	1	Q	80½	81
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	123*	123*

*Last price quoted.

Personal

Dr. William Marconi is expected to arrive in New York early in January. He is still under the care of an oculist.

Mr. C. C. Ousley has recently been appointed to the newly created position of assistant to the president of the Kentucky Electric Company, Louisville, Ky.

Mr. William J. Meloney, formerly manager for the Western Union Telegraph Company at Atlantic City, N. J., and Altoona, Pa., has been appointed manager at Trenton, N. J.

Mr. Henry L. Doherty, of Henry L. Doherty & Company, has recently returned to this country after an absence on business in London, England, where he has spent a number of weeks.

Mr. C. G. Kilbourne, of the New York Edison Company, delivered an address on Nov. 21 before the Electrical Engineering Society of Columbia University, on "The Distribution System of a Large City."

Mr. E. A. Thompson has been appointed manager of the properties of the Hillsboro Electric Light & Power Company at Coffeen, Ill., and will also look after the company's affairs at Fillmore and Donnellson.

Mr. John M. Eshleman, chairman of the Public Utilities Commission of California, at a recent meeting of the Boston (Mass.) City Club, delivered an address on "Control of Public Service Corporations by a Single Commission."

Mr. W. E. Erwin, who for the past seven years has been assistant superintendent of the San Bernardino division of the Pacific Electric Railway, San Bernardino, Cal., has resigned and will become associated with the Santa Barbara (Cal.) Consolidated Electric Company as superintendent.

Mr. H. P. Rust, who is associated with Vielé, Blackwell & Buck, consulting engineers for the Great Western Power Company, retains his connection with the engineering firm and has not been placed in charge of one of the developments of the Great Western Power Company, as incorrectly stated in our issue for Nov. 23.

Mr. R. A. Sara has tendered his resignation as business manager of the Power Department of Winnipeg, Canada. Mr. Sara, who has been in charge of the organization and business of the department for eighteen months, will return to his home in Toronto, where he will be identified with the Hydro-Electric Commission of that city.

Mr. Theodore D. Crocker, who for the past six years has been connected with The Milwaukee Electric Railway & Light Company, recently resigned his position to become associated with the Byllesby interests at St. Paul. Mr. Crocker was vice-president of the Milwaukee company's section of the National Electric Light Association.

Mr. Frank L. Dyer has resigned as president of the various companies manufacturing devices under patents of Mr. Thomas A. Edison. Mr. Dyer has been identified with Mr. Edison's undertakings for the past ten years and at the time of his resignation was president or director and legal adviser for nineteen different corporations in which Mr. Edison is interested.

Mr. D. G. Baker, works manager of the Olds Motor Works, Lansing, Mich., and formerly manager of the Blake & Knowles Steam Pump Works, Cambridge, Mass., has just returned from Ghent, Belgium, where he concluded arrangements with Carels Brothers, the largest exclusive builders of Diesel engines in Europe, for becoming manager of their plant at that place. He will sail in a few days with his family for Belgium.

Dr. Frederick Bedell, professor of applied electricity at Cornell University, is receiving the profound sympathy of his many friends because of the loss of his father, Mr. Edwin F. Bedell, who died on Nov. 21, at the age of seventy-six, at his home in Montclair, N. J., where he had lived for almost forty years. It was only a few months ago that the late Mr. Bedell and his wife celebrated the fiftieth anniversary of their wedding. Besides Professor Bedell, the widow of the deceased, another son and three daughters survive him.

Mr. Chauncey L. Williams has resigned as Western manager of the *Electrical World* and will remove from Chicago to New York to accept a position of authority with the F. W. Dodge Company, publisher of the *Architectural Record,* "Sweet's Index" and other periodicals. His successor will be **Mr. Sam A. Hobson,** whose interests and activities in the electrical field are shown by the fact that he was one of the founders, the first Pluto and the third Jupiter of the Rejuvenated Order of the Sons of Jove. Mr. Hobson was until lately manager of the Fort Wayne Electric Works.

Mr. J. M. Wakeman, former vice-president of the McGraw Publishing Company and general manager of the *Electrical World,* after an absence of nearly two and one-half years, the greater part of which has been spent in his native country, England, arrived in New York last week on the S. S. *Adriatic* for a visit of indefinite length. His headquarters for the immediate future will be the Hotel Alvord, East Orange, N. J. Mr. Wakeman's friends will be pleased to learn that as a result of the time spent outdoors in France, Italy, Belgium, the Austrian Tyrol, Scotland and Wales, as well as England, he appears many years younger than he did when he left here.

J. M. WAKEMAN.

Mr. Warner M. Skiff, for the past three years assistant manager of the engineering department of the National Electric Lamp Association, has been appointed manager of the engineering department of the association to succeed Mr. Glenn C. Webster, who has assumed the managership of the Tungstolier Works of the General Electric Company. Mr. Skiff was born Oct. 5, 1883, in Jamestown, N. Y., where he received his high-school education. His technical education was obtained at Case School of Applied Science, from which he was graduated in 1906. While at this school he became a member of the Tau Beta Pi honor fraternity and later was elected to the Sigma Xi honor society. During his early years Mr. Skiff obtained valuable practical experience through his connection with the Peerless Electric Company, of Warren, Ohio. In July, 1906, he joined the engineering department of the National Electric Lamp Association, which at that time comprised not more than a half dozen men. The department now employs nearly a hundred engineers and specialists. Mr. Skiff is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the National Electric Light Association, the Cleveland Advertising Club and the Sons of Jove.

WARNER M. SKIFF.

Obituary

Mr. Charles Bourseul, who has been credited with first suggesting the possibility of the electrical transmission of speech, died in Paris, France, on Nov. 25, at the age of eigthy-three. His prophecy was regarded at the time as so novel and incomprehensible that Du Moncel, by whom the account was first published, pronounced it a wholly fantastic idea. Mr. Bourseul did not propose or construct any mechanism which would successfully transmit speech or complex sounds by electrical means. For many years he had been receiving a pension from the Post Office Department.

Construction

FLORENCE, ARIZ.—The Florence Improvement Co. has applied to the Board of Aldermen for a franchise to supply water and electricity here. The question will be submitted to the voters.

ALAMEDA, CAL.—Contracts have been awarded by the electricity commission for construction of power house and equipment, aggregating $122,170 as follows: Construction of power house to Kaufman & Edwards, $30,998; regulators, $6,785, and switchboards, $10,440, to the General Electric Co.; boilers, $25,715, and oil tanks,, $3,758, to C. C. Moore & Co.; turbine unit, $44,494, to Hunt, Mirk & Co.

HEMET, CAL.—The State Railroad Commission has approved the application of the Southern California Utilities Co. to issue bonds to the amount of $10,000,000 for the purpose of carrying out its plans for an irrigation, power and land system in Riverside County. The project includes the purchase of the property of the Ramona Pwr. & Irrig. Co., at $350,000; the Lake Hemet Wtr. Co., the Fairview Land & Wtr. Co., the Hemet Town Wtr. Co. and the Hemet Land Co., at $1,417,992; for the purchase of two-thirds of the stock of the California Riverside Land Co., at $3,150,000; for the construction of power plant and irrigation system, $4,117,000. The remainder of the fund is to be used for improvements of lands, water sites and other properties.

LOS ANGELES, CAL.—The city of Los Angeles is planning to install a system of ornamental street lamps on Canal Street, in the Wilmington district; also on Jefferson Street from Central Avenue to Vermont Avenue.

LOS ANGELES, CAL.—Specifications and estimates of cost for the construction of a section of street railway on San Pedro Street from Aliso to Ninth Street have been prepared by the Board of Public Works. The cost is estimated at $208,520 and calls for completion in eight months. The Pacific El. Ry. Co., it is expected, will get the contract.

LOS ANGELES, CAL.—The Little Rock Pwr. & Wtr. Co., of Los Angeles County, has applied to the State Railroad Commission for permission to issue 3000 shares of capital stock and $5,000,000 in bonds. The greater part of the stock is desired for the purchase of all rights and interest to water and water rights in Little Rock Creek in Los Angeles County. The proceeds from the bonds will be used to construct a power plant and distributing system.

MARYSVILLE, CAL.—The Oro El. Corpn., of Oroville, has applied to the County Supervisors for permission to erect and operate an electric distributing system in Yuba County. R. Leo Van der Naillen is general manager.

MODESTO, CAL.—The Modesto & Empire Trac. Co. is preparing to extend its railway 30 miles west to Newman.

OROVILLE, CAL.—The Oro El. Corpn. is erecting a transmission line to the Haseltine and East Biggs districts, where electricity will be supplied for lamps and motors. The company contemplates the erection of many transmission lines to radiate from Oroville. A. A. Davis is local manager.

PASADENA, CAL.—R. H. Davis, D. M. Linnard and others are planning a proposed ornamental street-lighting scheme for Los Robles Avenue, from Orange Grove Avenue to California Street, and possibly on to Huntington Drive, a distance of over 3 miles. Over 200 posts similar to those on Orange Grove Avenue will be erected.

SAN DIEGO, CAL.—T. H. Wilson, of Vancouver, B. C., Can., who is said to represent Canadian capitalists, has acquired a site on the bay front at San Diego and will soon begin work on the construction of an electric power plant.

SAN FRANCISCO, CAL.—The Coast Counties Gas & El. Co. has asked the State Railroad Commission for permission to purchase the Davenport Lt. & Pwr. Co., of Davenport.

SANTA MONICA, CAL.—Bids will be received by the treasurer of the National Soldiers' Home, Los Angeles County, until Dec. 11 for furnishing and installing an electric passenger elevator in the hospital building.

VISALIA, CAL.—The Mount Whitney, Pwr. & El. Co. has applied to the State Railroad Commission for permission to issue bonds to the amount of $250,000. The proceeds will be used for the construction of generating plants and reservoir on the Kaweah River. The application states that about $350,000 has been expended on the plant and that it will require the expenditure of about $1,000,000 to complete it.

WENGLER, CAL.—The Mount Shasta Pwr. Co. has just completed a small hydroelectric power plant to be used in driving a 7-mile tunnel. The tunnel is a part of the large power development being undertaken by the Mount Shasta Pwr. Co.

DENVER, COL.—Arrangements have been made by the city to install new lighting systems at University Park, Lake Place and Federal Boulevard, which will involve an expenditure of approximately $40,000.

ROCKY FORD, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co. contemplates extending its 13,000-volt transmission line from Rocky Ford to Ordway, a distance of 12 miles, for the purpose of furnishing electricity to the towns of Ordway and Sugar City. The work will be done by the company in charge of E. F. Stone, Pueblo, superintendent of the lighting and power department. Material for the proposed extension has been purchased. W. F. Raber, of Pueblo, is vice-president and general manager.

WALSENBURG, COL.—The plant of the Walsenburg Lt. & Pwr. Co., inside city limits, has been taken over by the Trinidad Elec. Transmis. Ry. & Gas Co., and all electrical machinery, engines, etc., will be sold. The ice-manufacturing and cold-storage plants will be continued, and a portion of the boiler plant will be left for this purpose.

EAST HADDAM, CONN.—The East Haddam & Haddam Bridge Commission has awarded the East Haddam El. Lt. Co., of East Hampton, Conn., a contract for furnishing electricity for operating the drawbridge and for lighting the bridge under construction here for a period of years.

HIGGANUM, CONN.—Plans are being prepared to install an electric-light system here. Electricity for operating the system will be supplied by the East Haddam El. Lt. Co., of East Hampton, which has a plant on the Salmon River at Leesville.

WILLIMANTIC, CONN.—The city has entered into a new contract with the Willimantic El. Lt. Co. for street lighting for a period of five years. The price for arc lamps has been reduced from $92 to $80 per year. The new contract also provides for not less than 80 incandescent lamps at $20.50 each per year.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 14 for furnishing two 75-kva steam-driven alternating-current generator sets and switchboard for the United States naval station at Guantanamo, Cuba, to be delivered at the navy yard, Brooklyn. N. Y. Specifications can be obtained on application to the bureau. William M. Smith is acting chief of bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 10 for furnishing supplies at the navy yards and naval stations as follows: Washington, D. C., Schedule 4967—electric locomotive. Norfolk, Va. Schedule 4991—two motors for engine lathes; Schedule 4990—five panels for direct-current generator switchboards. Application for proposals should designate the schedule desired by number.

JACKSONVILLE, FLA.—Proposals will be received by W. M. Bostwick, chairman of trustees for the water-works and improvement bonds of the city of Jacksonville, until Jan. 6, 1913, for furnishing and installing lead-covered underground electrical cables in accordance with plans and specifications on file in the office of the board, Jacksonville, and in the office of W. E. Bleo, consulting engineer, Washington, D. C. Proposals are requested on three different propositions as follows: (1) For furnishing f.o.b. cars at Jacksonville the several items of said cables as called for by specifications; (2) separate prices on unit basis for furnishing and installing said ducts and manholes constructed by the city of Jacksonville; (3) alternate price on a percentage basis for installing said cables in said ducts and manholes in city of Jacksonville. Copies of plans and specifications may be secured of the consulting engineer upon deposit of $25, which will be refunded upon return of same.

DOUGLASVILLE, GA.—Plans are being considered for the installation of a municipal electric-light plant here, for which bonds have been voted.

BOISE, IDAHO.—The Idaho Trac. Co. has been granted permission to lay tracks on certain streets in the city of Boise.

ASSUMPTION, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the electric light and power plant of the Consolidated El. & Mfg. Co., of Assumption, for $40,000.

CHICAGO, ILL.—The Trustees of the Sanitary District of Chicago have entered into a contract with the city of Chicago for furnishing electricity to operate the Fullerton Avenue pumping station. The board has also authorized its president to sign a five-year contract with the trustees of the village of Wilmette to furnish electricity to that village. Thomas A. Smyth is president of the board of trustees of the Sanitary District of Chicago.

CHICAGO, ILL.—Steps have been taken by City Electrician Ray Palmer for illumination of streets running under all railroad elevations. A request for an appropriation of $74,000 has been filed with Comptroller Traeger to illuminate the 375 subways under municipal control. A general letter has been sent to all railroads asking them to take care of the 275 subways which they are compelled by ordinance to keep lighted. It is estimated that 7400 incandescent lamps, costing $10 each, will be required for the 375 subways under municipal control.

CREAL SPRINGS, ILL.—The city authorities have closed a contract with the Creal Springs Hotel Co. whereby the latter will furnish electricity for street lamps until May 1.

DECATUR, ILL.—The contract for electrical work for Macon County Hospital has been awarded to the Rex Electric Company, of Decatur, for about $8,000.

KEYESPORT, ILL.—The Springfield & Southern Illinois Trac. Co. has applied to the Village Board for a franchise to operate its interurban line through the city. A franchise will soon be asked of the City Council at Greenville.

MARION, ILL.—The Central Illinois Pub. Ser. Co. has purchased the plant of the Marion El. Lt., Wtr. & Pwr. Co. for $150,000.

RICHMOND, ILL.—The Public Ser. Co., of Waukegan, and the Equitable El. Lt. Co., of Lake Geneva, are seeking franchises in Richmond. The Public Service Company has already extended its system from McHenry to Johnsburgh and is said to be contemplating extending its transmission lines to Spring Grove, Solon and Ringwood.

ROCK FALLS, ILL.—The Illinois Northern Utilities Co. has offered the city of Rock Falls $17,000 for the municipal electric-light plant.

SPRINGFIELD, ILL.—The city commission has offered to purchase the Fourth Street boulevard lighting-system from the Springfield Lt. & Pwr. Co. for $10,000.

WATSEKA, ILL.—A deal has been closed whereby the Central Illinois Utilities Co. has taken over the electric plants in Watseka, Milford, Gilman and Onarga. It is stated that the new company proposes to build a new plant near the junction of Sugar Creek and the Iroquois River, in the western part of Watseka, to cost about $100,000. It is understood that arrangements are being made by the new owners to increase temporarily the output of the Watseka plant. The officers of the company are: L. E. Meyers, president; H. L. Clark, vice-president and manager, and H. P. Weston, secretary and treasurer, all of Chicago. H. J. Frith, of Watseka, it is understood, will have charge of the plants in this county.

HAMMOND, IND.—The large power plant of the Standard Steel Car Foundry in Hammond was destroyed by fire recently, causing a loss of about $250,000.

HAMMOND, IND.—The Northern Indiana Gas & El. Co., of Hammond, has begun work on the construction of a power plant at Indiana Harbor and Calumet River, to cost about $1,000,000.

MORRISTOWN, IND.—Arrangements have been made between the Town Board and the Indianapolis & Cincinnati Trac. Co., whereby the company will furnish electricity in Morristown for street-lighting and domestic purposes.

AFTON, IA.—The citizens have voted to accept the proposition of the Creston Mutual El. Lt., Ht. & Power Co. to furnish electricity for the local system. The Creston company will erect the transmission line to the Afton city limits.

ANKENY, IA.—The Central Iowa Lt. & Pwr. Co., which was recently granted a franchise to supply electricity here, will secure electrical energy to operate the system from the high-tension transmission line of the Fort Dodge, Des Moines & Southern R. R. Co. The work will be done by the railroad company. Frank K. Shuff is superintendent of the Fort Dodge, Des Moines & Southern R. R. Co.

ARMSTRONG, IA.—P. H. Atwood is contemplating the installation of an electric-light plant in connection with the tile factory.

CEDAR RAPIDS, IA.—The Iowa Ry. & Lt. Co. will build an addition to its power house in this city. W. G. Dows is president and J. D. Waedle superintendent.

CHELSEA, IA.—At a special election held recently the proposition to grant a new electric-light franchise to Dows, Smith, Reed & Cook was carried. This franchise is for the Iowa Ry. & Lt. Co., which recently purchased the local electric plant. The company proposes to furnish electricity for the local system from the Cedar Rapids and Marshalltown plants.

CLEARFIELD, IA.—At an election held recently the citizens voted to grant a 10-year franchise to a local company for the installation of an electric light and power plant. The system is to be in operation before April, 1913.

DALLAS CENTER, IA.—The City Council has granted the Adel Mill Co., of Adel, a franchise to supply electricity in Dallas Center.

FREDERICKSBURG, IA.—Bonds to the amount of $4,500 have been voted for the installation of an electric-light plant. H. S. Kerssen is city clerk.

HUDSON, IA.—At a special election held recently the proposition to grant a franchise for the installation of an electric-light and power plant was carried. Work will begin at once on construction of the plant, the cost of which is estimated at about $5,000.

HUMESTON, IA.—At a special election held recently the proposition to grant the Leon El. Co., of Leon, a 20-year franchise to operate an electric-light system here was carried.

KEOKUK, IA.—The Iowa Tel. Co. has taken over the plant of the Mississippi Valley Tel. Co. The exchanges will be consolidated.

LEON, IA.—The Leon El. Co. has begun work on the erection of its transmission line from Leon to Garden Grove and Humeston to supply electricity for lamps and motors in those towns.

MARSHALLTOWN, IA.—The Iowa Ry. & Lt. Co. has submitted a proposition to the City Council to furnish electricity for all ornamental lighting systems at a rate of $2.25 per month per post, carrying five-lamp clusters.

REDFIELD, IA.—At an election held recently the proposition to issue $15,000 in bonds for the installation of an electric-light plant and water-works system was carried.

ROWAN, IA.—J. L. Sinclair is considering the construction of an electric-light plant here.

SCRANTON, IA.—At an election held recently the proposition to install an electric-light plant here was carried. Work will soon begin on installation of the system.

WHITING, IA.—The proposition to establish an electric-light plant in Whiting will be submitted to the voters on Dec. 2. The Alamo Engine & Supply Co., of Omaha, Neb., has charge of the engineering work.

WINTHROP, IA.—Bonds to the amount of $5,000 have been voted for the installation of an electric-light plant. As yet no engineer has been engaged.

CIMARRON, KAN.—Sealed bids will be received by Roy Baker, city clerk, Cimarron, until Dec. 6 for furnishing labor and materials for additions and improvements to the municipal electric-light plant and water-works system as follows: Section 2—for furnishing all cast-iron pipe and special castings; Section 3—for furnishing all materials and labor (excepting cast-iron pipe, specials, valves and hydrants and transformers) for constructing water-works distributing system, power house, well and electrical distributing system; Section 4—for furnishing and installing on foundations furnished by the city one 50-hp internal combustion engine; Section 5—electrical machinery. Plans and specifications may be seen at the office of the city clerk, Cimarron, and at the office of Worley & Black, engineers, Kansas City, Mo.

DODGE CITY, KAN.—The Atchison, Topeka & Santa Fé Railway system is planning to build a power house, trestle and elevated coal bins in Dodge City this winter, to cost approximately $11,307.

OTTAWA, KAN.—Joseph Beeler is interested in a project for the organization of a company to supply electricity to the Franklin County farmers between Ottawa and Pomona, Centropolis and Homewood and in the towns. The company is to be known as the Overland El. Co. and will be capitalized at $30,000. Electricity for operating the system will be obtained from the municipal electric plant at Ottawa.

ELIZABETHTOWN, KY.—The property of the Elizabethtown El. Lt. Co. has been purchased by Harry Reid, of Versailles, representing a Chicago syndicate, which has purchased a number of plants in Kentucky, including those at Manchester, Versailles and Somerset.

FRANKFORT, KY.—The contract for the new lamp standards to be erected on Main and St. Clair Streets has been awarded to H. I. Wood & Co., of Louisville, for $3,250.

HOPKINSVILLE, KY.—Plans have been completed by the Hopkinsville Business Men's Association for the installation of ornamental lamp standards on Ninth and Main Streets.

LOUISVILLE, KY.—The organ factory of Henry Pilcher's Sons, Louisville, will be equipped with electrically operated machinery within a few months.

LOUISVILLE, KY.—The Seelbach Hotel Co., of Louisville, has applied to the municipal authorities for permission to close an alley in the rear of the hotel for the purpose of erecting an addition to its power house. The cost of the building and equipment is estimated at $50,000.

LOUISVILLE, KY.—The George G. Fetter Ltg. & Htg. Co., of Louisville, has taken over the contracts for installing an ornamental street-lighting system on Main Street, from First to Seventh Street, and has placed the first lamp standards for the system. These contracts were formerly held by the Louisville offices of the Federal Sign System.

NEWPORT, KY.—The Union Lt., Ht. & Pwr. Co., of Newport, is completing arrangements with the municipal authorities for the erection of ornamental lamp standards about the Court House Square in Newport.

DE RIDDER, LA.—The City Council has adopted a resolution authorizing the administration to secure estimates of the cost of installing a municipal electric-light plant and also submitting the proposition to issue bonds to pay for same to the taxpayers.

LEWISTON, MAINE.—The contract for installing lamp standards for the proposed ornamental street lighting has been awarded to the Ornamental Ltg. Pole Co., of New York, N. Y., at $66 per standard. The plans provide for the installation of 100 posts.

EMMITSBURG, MD.—A company has been organized by residents of Emmitsburg to supply electricity for lighting the town. Power for operating the system will be secured from the new power plant of the Frederick R. R. Co. A transmission line will be erected from Thurmont to Emmitsburg. The company will be capitalized at $6,000. Dr. J. B. Brawner, Dr. E. A. Stone, Annan Horner and Albert M. Patterson are interested.

NEW BEDFORD, MASS.—The New Bedford Gas & El. Co., in response to a petition, has agreed to extend its electric-light service from Padanaram through Elm Street to the section at the head of Apponegansett.

PALMER, MASS.—The Selectmen have granted the Warren Pwr. Co. a franchise to install and operate an electric system. The company proposes to develop a water-power on the Quaboag River, near West Warren.

BELLEVILLE, MICH.—Work has been started on the dam of the Eastern Edison Co. on the Huron River. The cost of the dam is estimated at about $200,000.

DEERFIELD, MICH.—Charles Schroeder & Co., proprietors of the local electric-light plant, have purchased an 80-hp, three-cylinder oil engine for their plant.

DETROIT,, MICH.—The American Lady Corset Co., of Detroit, will soon be in the market for a 500-kw direct-connected generating unit for its power plant.

DETROIT, MICH.—The Greater Detroit Improvement Association is interested in the project to install an ornamental lighting system on Jefferson Avenue from Montclair Avenue to the Chalmers Motor Car Company's plant. Representatives of the Detroit City Gas Co. and the Federal Sign Co. have submitted propositions to supply the necessary poles and maintain the lamps.

ELKTON, MICH.—The Business Men's Association contemplates the erection of a number of electric arches on Main Street.

FLINT, MICH.—The Detroit United Railway proposes to extend its line into the Fourth Ward from the north side of the river.

FLINT, MICH.—The Durant-Dort Carriage Co., of Flint, Mich., is in the market for a large generator and other electrical equipment for its power plant.

HOUGHTON, MICH.—The Sturgeon River Land & Improvement Co., composed of New York capitalists, has purchased 18,000 acres of land lying for 25 miles along the Sturgeon River, south from Houghton, from Walter S. Prickett, of Sidnaw. The consideration was $3,000,000, and it is understood that the company will develop a 2000-hp hydroelectric plant, at a cost of $4,000,000. The company proposes to supply electricity to the mines in the copper country. Transmission lines will be erected through Globe and along the line of the Copper Range mines to Portage Lake, from which branches will be run to scattered mines. Contracts for lighting cities and villages will be sought.

KALAMAZOO, MICH.—The Michigan United Trac. Co. contemplates extending its railway to South Haven.

LANSING, MICH.—The Board of Water Works and Electric Lighting Commissioners has awarded the contract for six new boilers for the municipal electric-light plant to the Wickes Boiler Co., of Saginaw, for $27,775.

TRAVERSE CITY, MICH.—The Citizens' Tele. Co. will reconstruct its toll line between McBain and Lake City and the Grand Rapids toll line between Cadillac and Leroy. Considerable new work will be started by the company in the spring. Plans are also being prepared for the underground conduit into the court house and also for the high school building. Albert Stacey, of Grand Rapids, is superintendent.

WHITEHALL, MICH.—The United Home Tel. Co., of Ludington and Muskegon, is having plans prepared for the erection of a new exchange building here.

COLD SPRING, MINN.—The Union Pwr. Co. has begun work on the erection of a distributing station here.

KENYON, MINN.—The Village Council has granted a 25-year electric-light franchise to the Consumers' Pwr. Co., of Stillwater. A. S. Huey, of Chicago, Ill., is president.

NORTH ST. PAUL, MINN.—Improvements will be made to the local system of the Northwestern Tel. Exchange Co., to cost from $10,000 to $15,000. Wires will be replaced with cables wherever possible.

OLIVIA, MINN.—The contract for furnishing a gas-producer unit for the municipal electric-light plant has been awarded to the International Gas Engine Co., of Minneapolis, at $5,687.

OWATONNA, MINN.—Bonds to the amount of $10,000 have been voted for the installation of a new street-lighting system.

PIPESTONE, MINN.—The City Council has entered into a new contract with the Pipestone El. Lt., Ht. & Pwr. Co., whereby a new street-lighting system will be installed. The contract is for a period of ten years and calls for 83 100-watt multiple or series tungsten lamps, two 250-watt tungsten lamps and four flaming-arc lamps. The Council has adopted an ordinance granting an extension of the company's franchise for 21 years from Nov. 11, 1912.

VIRGINIA, MINN.—The new Range Tel. Co. will erect an administration building and central office in Virginia, to cost about $15,000.

WANAMINGO, MINN.—The Consumers' Pwr. Co. will erect transmission lines from its power plant at Cannon Falls to Wanamingo to supply electricity for lamps and motors here.

WOLVERTON, MINN.—Steps have been taken by E. E. Norton, of Breckenridge, to organize a company to install an electric-light plant here.

ST. JOSEPH, MO.—The St. Joseph Ry., Lt. & Pwr. Co. contemplates building an addition to its power plant on Felix Street, increasing the output 50 per cent. The equipment will include a 3000-kw turbine engine and a 1000-hp boiler. The cost of the work is estimated at $100,000. J. H. Van Brunt is general manager.

ST. LOUIS, MO.—The North Grand Avenue Improvement Association has appointed a committee to solicit subscriptions for the lighting fund for the purpose of installing a new lighting system on Grand Avenue, from the water tower to Easton Avenue. Charles C. Weber is president of the association.

RAVALLI, MONT.—The Mountain States Tel. & Teleg. Co. is planning to construct a telephone line between Ravalli and Polson, Mont.

TERRY, MONT.—The Council is considering the question of granting a franchise for the installation of an electric-light plant here.

DESHLER, NEB.—The Deshler Lt. & Pwr. Co. contemplates extending its system to neighboring towns and will also furnish electricity for lamps and motors to farmers along its lines.

GOLCONDA, NEV.—The Golconda Tel. & Pwr. Co. has just finished a survey for an electric transmission line from Golconda to National and McDermott. The line is to be built immediately. R. E. Tilden is engineer.

GOLDFIELD, NEV.—The Goldfield Ore Mining Co. will install electrically operated apparatus, including hoist, compressor, sinking pump and miscellaneous machinery.

RENO, NEV.—The Reno Smelting & Refining Co., recently incorporated with a capital stock of $1,000,000, is planning to erect a custom smelter east of Reno, near the Truckee River, within the next year, at a cost of $500,000. An electric smelting furnace invented by John S. Loder will be used. The incorporators are: John S. Loder, engineer and metallurgist, and Marvin E. Hall, both of Detroit, Mich.

KEYPORT, N. J.—The Public Utility Commission has approved the ordinance of the Monmouth County Board of Freeholders granting the Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. a franchise to erect a transmission line on Kings Highway in Middletown Township.

MOGOLLON, N. M.—Extensive improvements are contemplated in the Mogollon mining district, including the installation of a central power plant, which will furnish power to all the mines in this district. It is also proposed to erect a mill of 1000 tons capacity at the tunnel portal. W. J. Weatherby is in charge.

FORT PLAIN, N. Y.—The Century Cabinet Co. contemplates the installation of a power plant in connection with its works at Fort Plains. Griggs & Holbrook, 5 William Street, New York, N. Y., are engineers.

FULTON, N. Y.—The Volney Paper Co. is having plans prepared for the construction of a power house, 50 ft. by 35 ft.

GREAT NECK, N. Y.—Bids will be received by the Board of Education of the Union Free School District No. 7 until Dec. 14 for the installation of heating and electrical apparatus in the new high school building. William T. Towner, 320 Fifth Avenue, New York, is architect.

HAMBURG, N. Y.—The property of the Howard A. Pierce El. Lt. Co., of Hamburg, has been purchased by a syndicate of Hamburg and Buffalo business men. The new owners contemplate improvements to the system. The officers of the new company are: Albert Dodge, president, and Walter Nurzey, secretary, both of Hamburg, and William Mair, of Buffalo, treasurer.

NEW HAMBURG, N. Y.—The village of New Hamburg has awarded a contract to the Central Hudson Gas & El. Co., of Poughkeepsie, for lighting the streets of the village. The contract provides for 22 lamps.

ROME, N. Y.—Sealed bids will be received until Dec. 2 by A. L. McAdam, clerk of the Board of Supervisors, Court House, Utica, N. Y., for installation of elevators at the County Hospital at Rome. Plans and specifications are on file at the office of the clerk of board. Elmer E. Palmer is engineer.

HAMILTON, N. D.—The installation of an electric-light plant in Hamilton is under consideration.

COLUMBUS, OHIO.—Plans have been prepared for the installation of an incandescent street-lighting system on arc circuits. The plans provide for about 500 ornamental lamp standards, each carrying five 100-watt tungsten lamps. For underground work use will be made of 3-in. Orangeburg fiber conduit laid in concrete. The cost of standards wired and installed complete is estimated at $47.31 each; that of No. 10 duplex rubber-covered lead-incased cable installed per ft. at 99.5 cents. The total cost of the system complete is estimated at $85,400 and provides for placing the standards about 100 ft. apart on the same side of the street and staggered. This requires about 100 ft. of cable per standard. Part of the work will be done early next summer. H. E. Eichborn is superintendent of the municipal electric-light plant.

COSHOCTON, OHIO.—The Coshocton Lt. & Htg. Co. will install a second steam-turbine engine at the Fourth Street plant, increasing the output to 2500 kw. The company is extending its transmission lines to Pleasant Valley and expects to extend its lines to surrounding towns to supply electricity for lamps and motors. J. Howell is manager.

DELPHOS, OHIO.—Plans have been adopted by the Commercial Club committee for the ornamental street-lighting system on Main Street. The plans provide for 22 standards each carrying a five-lamp cluster and 12 standards carrying a three-lamp cluster. The Cutter boulevard straight-arm post has been adopted.

FREMONT, OHIO.—The Public Service Commission has authorized the Fremont Home Tel. Co. to issue $25,000 in capital stock. The proceeds will be used for improvements to its plant and system.

MASSILLON, OHIO.—The Massillon El. & Gas Co. contemplates extending its transmission lines from the west corporation line of Massillon to the Wayne County line and thence to East Granville. The company also proposes to erect a transmission line from Navarre to Brewster and a branch from Brewster to a silica sand mill in Sugar Creek Township. Franchises have been secured for the proposed lines.

PAULDING, OHIO.—The municipal authorities are considering the question of purchasing electricity from the Auglaize Pwr. Co. to operate the municipal electric-light and water-works plant. It is proposed to connect with the company's line at Charloe.

TOLEDO, OHIO.—Plans and specifications for the new power plant, to cost $25,000, for the new county tubercular hospital and county infirmary, to be located between the town buildings on Arlington Avenue, have been approved by the County Commissioners. D. L. Stine is architect.

ENTERPRISE, ORE.—The Home Tel. Co. is planning to improve its lines in Wallowa County. Work on the line between Enterprise and Joseph, a distance of about 7 miles, will begin at once.

EUGENE, ORE.—The Oregon El. Ry. Co. will extend its electric line from Eugene to Roseburg, a distance of about 65 miles.

MARSHFIELD, ORE.—The C. A. Smith Lumber & Mfg. Co. is building an electric power plant in connection with its lumber and logging operations. The plant is nearly completed. The equipment will consist of one mixed-pressure 2000-kw General Electric turbine and one 500-kw high-pressure turbine. The cost of the plant is estimated at about $125,000. Arno Moreen is general superintendent.

MILTON, ORE.—An election will be held Dec. 10 to vote on the proposition of issuing $18,000 in bonds for improvements to the municipal lighting system.

REDMOND, ORE.—The Council has granted George Jacobs, of Portland, Ore., a franchise to construct and operate an electric-light plant here.

BLAIRSVILLE, PA.—The Citizens' Lt., Ht. & Pwr. Co., of Johnstown, has decided to close down its electric plant in Blairsville, which it purchased several months ago, and furnish electricity from the Broad Street station to operate the system in Blairsville. Although the current will be supplied by the Citizens' company, the rights-of-way and franchise are being secured by the Penn Pub. Ser. Co., which is connected with the local company. A franchise has been granted to the Penn Pub. Ser. Co. in New Florence. The Seward Council is now considering an ordinance granting the Penn company a franchise in that town. In New Florence and Seward the Penn Pub. Ser. Co. will furnish electricity for lighting streets, residences and business and for mines and other industries. To meet the increasing demand the Citizens' Lt., Ht. & Pwr. Co. is installing a substation at its Broad Street plant. August Weiss is manager.

JOHNSTOWN, PA.—The Citizens' Lt., Ht. & Pwr. Co., of Johnstown, has closed a contract by which the company will supply electricity for operating the machinery and lighting the Lochrie Coal Company's mine at Scalp Level. Surveys are now being made for extension of the transmission line from Johnstown to Scalp Level. Plans are also under way by the company for extension of its lines through Shade Township, which will be followed by the extension of lines through the entire district. The company proposes to erect transmission lines in all territory in Somerset County without electrical service.

NORTHAMPTON, PA.—The Lehigh Coal & Navigation Co. has awarded the contract for the construction of a substation at Northampton to Robert S. Rathburn, of Allentown. This will be the main distributing station for this county.

PHILADELPHIA, PA.—Owing to the failure of the Philadelphia El. Co. to submit a bid for the street-lighting contract for 1913, bids for lighting the city will be readvertised.

CHARLESTON, S. C.—The Charleston-Isle of Palms Trac. Co. is contemplating the purchase of additional rolling stock and will build about 35 miles of new track and line work. James Sottle is president of the company and W. W. Fuller is chief engineer and general superintendent. The main office of the company is in the New Charleston Hotel Building, Charleston. The company supplies electricity for lamps and motors in Mount Pleasant and Sullivan's Island, the Government Reservation and the Isle of Palms.

LENNOX, S. D.—The City Council is considering the construction of an electric-light plant.

WATERTOWN, S. D.—At an election to be held Dec. 10 the proposition to issue $15,000 in bonds for the installation of a cluster-lamp lighting system next spring will be submitted to a vote.

JONESBORO, TENN.—The Eastern Tennessee Hydroelectric Co., of Johnson City, contemplates the construction of an electric-light plant in Jonesboro.

GRAHAM, TEX.—The Graham Lt. & Supply Co. is constructing an electric-light plant (three-wire, 110-220-volt system) at a cost of about $7,500. The equipment will consist of a 65-kw generator, two boilers (100-hp and 40-hp respectively), one 11-in. by 16-in. four-valve Atlas engine; 25-cp and 50-cp incandescent lamps will be used for street lighting.

PORT ARTHUR, TEX.—The Port Arthur Lt. & Pwr. Co., recently organized with a capital stock of $600,000, has taken over the electric plant of the Port Arthur Trac. Co. The new company, it is stated, will also provide power for operating the interurban electric railway which is to be built between Port Arthur and Beaumont, a distance of 25 miles.

VICTORIA, TEX.—The Victoria Mfg. Co. is planning to install a 500-kw generating unit, consisting of steam turbine and electric generator, increasing output of electric plant to 920 kw. The capacity of the ice plant will be increased by 20 tons and the factory rebuilt. The cost of improvements is estimated at $40,000.

OGDEN, UTAH.—Preparations are being made by the Utah Lt. & Ry. Co. for the erection of a transmission line to North Ogden to supply electrical service here.

MONTPELIER, VT.—Plans are under way for the immediate installation of 3500-hp additional equipment at the Pioneer plant of the Consol. Lt. Co. in Montpelier.

REUSENS, VA.—The Lynchburg Trac. & Lt. Co., Lynchburg, is planning to install a 2500-hp generating unit at its plant in Reusens, to cost about $40,000. A. T. Powell is purchasing agent.

BURBANK, WASH.—The properties of the Burbank Pwr. & Wtr. Co. have been taken over by the Burbank Co., recently organized with a capital stock of $666,700. Operations are now on foot for a development to provide sufficient water for 7000 acres. The officers are: Frederick K. Struve, of Seattle, president; H. Hubert, of Sanderson & Porter, engineers, 52 William Street, New York, treasurer, and Elbert M. Chandler, of Burbank, manager.

CENTRALIA, WASH.—The Washington El. Co., which proposes to construct an electric line from Vancouver, Wash., to Tacoma, a distance of about 115 miles, has applied for a franchise to operate through Centralia.

GLACIER, WASH.—The Washington Anthracite Pwr. Co. is planning to erect a power plant on Glacier Creek, about 4 miles above Glacier, to supply electricity for lighting the tunnels of the company's coal mines here.

KENT, WASH.—The city of Kent will install street lamps on First and Second Avenues at once.

MORTON, WASH.—The Lewis County Commissioners have granted the Morton El. Co. permission to furnish electricity for lamps and motors in Morton.

MOUNT VERNON, WASH.—The Pacific Northwest Trac. Co. has been awarded the contract for furnishing electricity to light the city of Mount Vernon for a period of five years.

VANCOUVER, WASH.—The Portland Ry., Lt. & Pwr. Co. is installing an additional 1000-hp transformer in its substation on lower Eighth Street. The company will remove the substation which was built by the Mount Hood Co., east of Vancouver Barracks, to a site which it has purchased at the foot of Washington Street. The cost of moving and refitting the substation is estimated at about $40,000.

ZILLAH, WASH.—The North Yakima & Valley Ry. Co. will install a telephone system on its Zillah branch. Work will begin at once.

BLUEFIELD, W. VA.—Convertible notes to the amount of $500,000 have been sold by the Appalachian Pwr. Co., the proceeds of which will be used for the purchase of new properties in Virginia and West Virginia and to extend the plants of the company. H. M. Byllesby & Co., of Chicago, Ill., are engineers and managers.

DALLAS, WIS.—J. A. Anderson contemplates the installation of an electric-light plant here.

GREEN BAY, WIS.—The business men on West Walnut Street, between the bridge and Broadway, are contemplating the installation of luminous arc lamps on those blocks. It is proposed to erect 20 lamps. The proposition has been submitted to the Green Bay Gas & El. Co. C. R. Phenicie and David MacNaughton are interested.

MADISON, WIS.—Mayor Heim will appoint a Council committee to investigate the possibilities of obtaining electrical energy outside the city for municipal use. The question of securing power from the Southern Wisconsin Power Company's dam at Prairie du Sac is being considered.

NORWALK, WIS.—Bonds to the amount of $7,000 have been voted for the installation of an electric-light plant.

EDMONTON, ALTA, CAN.—Arthur G. Harrison, a member of the Board of City Commissioners, announces that the city will expend approximately $1,500,000 for street-railway construction, rolling stock, equipment and substations in Edmonton during the coming year. This is exclusive of the extensions to St. Albert and Calder and improvements to the present system, which is owned and operated by the city. Arrangements are being made by the municipality for the installation of an ornamental street-lighting system on Jasper, Whyte and Namayo Avenues and First Street. The plans provide for three standards to each block, costing from $275 to $300 each.

KAMLOOPS, B. C., CAN.—Tenders will be received by J. J. Carment, city clerk, until Dec. 5 for 1000-hp steam, pumping and electrical equipment for the new power station. Plans and specifications may be seen at the office of DuCane, Dutcher & Co., consulting engineers, Vancouver, B. C., or at the office of R. S. Lea, New Birks Bldg., Montreal, Que. Plans and specifications may be obtained upon a deposit of $15.

NEW WESTMINSTER, B. C., CAN.—The fire and light committee has decided to place 25 new arc lamps and a number of smaller lamps at different points throughout the city. P. T. Bowler is city electrician.

NEW WESTMINSTER, B. C.—The British Columbia Electric Ry. Co. may construct a line from New Westminster to Port Moody, a distance of about 20 miles. The Board of Trade and Progress Association are back of the movement.

VANCOUVER, B. C.—Waugh, Meisner & Bailey have been awarded the contract for the installation of ornamental lamp standards on Hastings, East Granville, Carroll and Main Streets, Vancouver, at $19,400.

DALHOUSIE, N. B., CAN.—The ratepayers have voted in favor of the proposition of installing an electric-light plant here, to cost about $20,000.

CANNINGTON, ONT., CAN.—At an election held Nov. 20 the by-law providing for the installation of an electric light and power system in conjunction with the Hydro-Electric Power Commission was carried.

FOREST, ONT., CAN.—Bids are being received by Richard Karr, town clerk, for the construction of an electric-light plant, plans for which were prepared by H. A. McLean, of Sarnia, Ont., engineer.

GALT, ONT., CAN.—A movement is on foot for lighting the roadway between the boundaries of Galt and Preston. The Township Councils of Waterloo and North Dumfries will be asked to co-operate with the Hydro-Electric Commission in the matter. The lighting of this road will be in the nature of an experiment.

NORTH BAY, ONT., CAN.—The ratepayers have voted in favor of the by-law providing for the installation of a municipal electric-light plant in conjunction with the Hydro-Electric Commission. The proposition to grant the Nipissing Pwr. Co., Toronto, a ten-year franchise was defeated.

TORONTO, ONT., CAN.—The Hydro-Electric Commission has signed contract with five municipalities to furnish hydroelectric power. The new towns to receive service from the commission are Brantford, Paris, Port Dalhousie, Brockville and Prescott. Work has begun on the extension of the transmission line from Prescott to Brockville, a distance of 20 miles.

New Industrial Companies

THE ELECTRICAL PRODUCTS CORPORATION, of Los Angeles, Cal., has filed articles of incorporation with a capital stock of $20,000. The incorporators are: C. L. Howe, F. E. Sweeney and P. D. Howe.

THE ELECTRIC SUPPLY & ENGINEERING COMPANY, of Staunton, Va., has been incorporated with a capital stock of $25,000 to $50,000. The officers are: W. G. Eager, of Staunton, president; L. D. Hamilton, of Valdosta, Ga., vice-president; H. C. Godfrey, of Staunton, secretary and treasurer.

THE ELECTRIC TACHOMETER COMPANY, of Camden, N. J., has been incorporated with a capital stock of $750,000 to deal in instruments for measuring and indicating speeds. The incorporators are: F. A. Kuntz, F. S. Muzzy and F. S. Saurman, of Camden.

THE KITTITAS ELECTRIC LAUNDRY & RENOVATING COMPANY, of Ellensburg, Wash., has been incorporated with a capital stock of $15,000 by W. G. Aebo, L. L. Scott and C. A. Scott.

THE A. L. LEWIS COMPANY, of Bluffton, Ind., has been incorporated with a capital stock of $10,000 to manufacture and deal in toys and light fixtures. The incorporators are: A. L. Lewis, George A. Lewis and T. L. Prall.

THE MIDWEST ELECTRIC & SIGN COMPANY, of Kansas City, Mo., has been incorporated with a capital stock of $15,000 by L. A. Thomas, M. R. and H. M. Green, F. W. and G. E. Thomas.

THE PEERLESS ELECTRIC SIGN COMPANY, of Dayton Ohio, has been granted a charter with a capital stock of $50,000 for the purpose of manufacturing and dealing in advertising devices. The incorporators are: W. W. Arnold, F. W. Howell and J. A. McGee.

THE SPLITDORF ELECTRICAL COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $65,000 by R. W. Sutherland and F. H. & J. M. Hanley.

New Incorporations

LITTLE ROCK, ARK.—The Arkansas Interurban Construction Co. has been incorporated with a capital stock of $500,000 to build an interurban line between Little Rock and Hot Springs. The officers are: W. H. Garanflo, of Little Rock, president; W. S. Sorrells, of Hot Springs, vice-president; L. Garrett, of Little Rock, secretary and general manager, and M. B. Moore, of Little Rock, treasurer.

CHICAGO, ILL.—The Chicago & Northern Interurban Ry. Co. has been incorporated with a capital stock of $100,000 to construct a railway from Chicago through the townships of Niles, Maine and Wheeling. The incorporators are: W. A. Miller, F. W. Hochspeier, O. J. Smith, W. E. Swanson and G. L. Starbird, all of Chicago.

MOUND CITY, ILL.—The Mound City Lt. & Wtr. Co., of Mound City, Ill., has been incorporated with a capital stock of $100,000 to operate electric, water, ice and steam plants. The incorporators are: H. E. Chubbuck, W. H. Carnahan, W. J. Achelpohl, E. W. Fowler and W. H. Creviston.

QUINCY, ILL.—Articles of incorporation have been filed for the Mississippi Valley Trac. Co. to build an interurban line from Springfield to Quincy. The company is capitalized for $25,000. The directors are: George M. Skelly and W. L. Campbell, of Springfield; Edward Cooper, of Kent, Ohio, and J. T. Creogore, of Youngstown, Ohio.

ROCK ISLAND, ILL.—The Coal Valley Lt. & Pwr. Co. has been incorporated by E. E. Walsh, Jr., H. M. Walsh and Paul Wagner. The company is capitalized at $10,000 and proposes to operate electric light and power plants.

LAFAYETTE, LA.—The Louisiana Trac. & Pwr. Co. has been organized with a capital stock of $250,000 for the purpose of constructing a system of interurban electric railways to run from Lafayette to the Sabine River and from Lafayette to Morgan City, Alexandria and Abbeville. The charter of the company gives it the privilege of supplying electricity for lamps and motors as well as to operate traction lines. The officers of the company are: J. A. Laundry, of Lake Charles, president; S. T. Woodring, of Calcasieu, vice-president; P. O. Moss, of Lake Charles, secretary, and D. J. Landry, of Lake Charles, treasurer.

VIRGINIA, MINN.—The Mesaba Lt. & Power Co. has been incorporated by Arthur McMillan, of Chicago, Ill.; R. B. Sperry, of New York, N. Y., and Senator James P. Boyle, of Eveleth. The company is capitalized at $1,000,000 and proposes to generate and distribute electricity for lamps, heat and motors.

CLEVELAND, OHIO.—The Eastern El. Co. has been incorporated with a capital stock of $10,000 by Charles O. Nelson, Charles P. Salen, M. A. Salen, Harmon Austin and Helena Smith.

CUSHING, OKLA.—The Cushing El. & Pwr. Co. has been incorporated with a capital stock of $15,000 by F. M. Overlees, H. Askin, J. W. Pollard, all of Bartlesville.

PITTSBURGH, PA.—The Greensboro El. Co. has been incorporated by C. G. Martin, W. R. Hammer, of Pittsburgh, and S. M. Miller, of Edgewood. The company is capitalized at $5,000 and proposes to operate in Greensboro.

PITTSBURGH, PA.—The Greene Township El. Co. has been granted a charter with a capital stock of $5,000 to operate in Greene Township. The incorporators are: F. J. Taylor, of Munhall; G. T. Smith, of Pittsburgh, and H. C. Dennison, of Bellevue.

PITTSBURGH, PA.—The Cumberland Township El. Co. has been granted a charter with a capital stock of $5,000 to operate in Cumberland Township. The incorporators are: H. A. Willard, of Bellevue; G. T. McConnell, of Millville, and C. R. Turton, of Aspinwall.

ABILENE, TEX.—The Abilene Gas & El. Co. has been organized by E. T. Thomas, D. Dellis and Glenn A. Smith, all of Abilene. The company is capitalized at $275,000 and proposes to install and operate an electric light and power plant here.

MANVEL, TEX.—The Suburban Gardens Tel. Co. has been incorporated with capital stock of $10,000. The incorporators are: T. E. Scott, W. R. Scott and W. R. Allison.

Trade Publications

FUEL ECONOMY.—"Making Heat Produce" is the title of a paper pointing to a definite fuel economy, which has been prepared by Dr. S. J. Herman for the Diamond Power Specialty Company, 80 First Street, Detroit, Mich., manufacturer of soot blowers for all standard boilers. Dr. Herman in giving the result of his research work has divided his material into four parts, as follows: "Making the Heat Generated Do Useful Work"; "Cleaning Removes the Soot Evil"; "How to Cut the Cost of Soot from the Coal Bills," and "The Investigation That Proves the Saving." The results of typical tests are given, with a number of tables. An illustrated appendix showing how mechanical soot cleaning may be applied to various types of boilers by means of the patented "Diamond" soot blowers is included.

INSULATORS.—The 1912 catalog—No. 51—of the Brookfield Glass Company, 2 Rector Street, New York, is being distributed. It is 8 in. by 10½ in. and contains 128 pages of specifications and illustrations showing the constructive features of the many types of insulators made by this company. An attractive feature of this well-made catalog is the appearance of five illustrations, printed with green ink and showing in exact size the Standard insulator used by the American Telephone & Telegraph Company, the extra-deep-grooved, double-petticoat insulator, the Nos. 2 and 3 cable insulators and the high-voltage, three-piece insulator, all well-known types of this company's products. Electrical engineers particularly interested in central-station matters will find this comprehensive publication of the Brookfield insulators of interest and value for ready reference.

ELECTRIC CONTROLLING APPARATUS.—A number of bulletins recently issued by the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., have been assembled within heavy pasteboard covers and contain considerable information on the various products of this company. Among them may be mentioned compression-type resistance units (Bulletin B-1), hand-operated, direct-current motor-starting rheostat (Bulletin B-2), type Z, direct-current automatic motor starter (Bulletin B-7), direct-current mill and crane controllers (Bulletin B-15), battery-charging rheostats (Bulletin B-40), battery-charging panel (Bulletin B-43), alternating-current, single-phase motor starters (Bulletin B-50), starting rheostats for three-phase slip-ring induction motors (Bulletin B-52), and others. Each bulletin contains brief, illustrated descriptions of the subject matter, with dimension tables and wiring diagrams.

SINGLE-PHASE MOTORS.—The Century Electric Company, St. Louis, Mo., is distributing a forty-eight-page catalog, known as Bulletin No. 18, which deals with the Century single-phase motors and their many applications. It contains a comprehensive description of the design, construction and operating characteristics of this company's apparatus. Twenty-three reasons are given why the Century single-phase constant-speed motors are preferred by so many central-station managers. The company has devoted seventeen years to the design and construction of these motors. There are many illustrations, showing the diverse character of the apparatus to which these motors are employed, among others being bread and cake mixers, ice-cream freezers, potato peelers, bottle washers, vacuum cleaners, organ blowers and heating systems. An attractive cover, excellent illustrations and reading matter, and the printing of the cuts in a color of ink to harmonize with the covers, combine to make a very creditable catalog.

MOTOR-DRIVEN PERFORATOR.—The American Perforator Company, 631 West Jackson Boulevard, Chicago, Ill., has recently placed on the market an automatic consecutive numbering perforator, which is illustrated and briefly described in a four-page leaflet recently issued by the company. This new machine, which has been perfected after almost a quarter of a century of experiment by its inventor, Mr. A. L. Day, the president of the American Perforator Company, has in one instance where it has been placed in use numbered automatically and consecutively about 4000 orders a day, each order embracing a great many pieces of paper. The machine, which is motor-driven, numbers all papers at one stroke, resulting in a great saving of time and absolute accuracy. The apparatus is so arranged that when desired a date or other information can be perforated at the time the numbering is being done. The American Perforator Company specializes on motor-driven perforating machines.

Business Notes

THE FRANCKE COMPANY, of New Brunswick, N. J., has recently announced that in the future the Smith-Serrell Company, Inc., of No. 90 West Street, New York City, will act as general sales agent for the Francke flexible coupling.

THE H. W. JOHNS-MANVILLE COMPANY has recently opened a branch warehouse at No. 31½ South Broad Street, Atlanta, Ga., in connection with its Southern agency for the purpose of minimizing delay in deliveries to its Southern territory.

MR. J. FRED ROTH, who has been electric light inspector for the Hartford (Conn.) Electric Light Company for the past six years, has resigned his position with the company to enter business for himself, under the firm name of the Cohn & Roth Electric Company, 290 Main Street, Hartford, Conn.

W. N. MATTHEWS & BROTHER, 3722 Forest Park Boulevard, St. Louis, Mo., are now represented on the Pacific Coast by Mr. L. E. Sperry at San Francisco, Mr. B. C. Chase at Los Angeles and Mr. H. G. Behneman at Seattle, who succeed the John R. Cole Company, which formerly represented Matthews & Brother in that territory.

THE ALPHA ELECTRICAL SUPPLY COMPANY, now located at 130 West Thirty-second Street, New York, will occupy offices at 116 West Twenty-ninth Street, New York, after Feb. 1, 1913. This company, which has obtained the Eastern selling agency for the Helios Manufacturing Company, Philadelphia, is developing for the market a 100-hour flaming-arc lamp.

WAGNER ELECTRIC MANUFACTURING COMPANY.—A 20 per cent increase in capitalization will be voted by the stockholders of the Wagner Electric Manufacturing Company at their annual meeting on the second Monday in January. This increase will be allotted to stockholders of record at par in the ratio of their present holdings in the company. There is $1,500,000 common stock outstanding at present and no preferred stock or bonds.

THE CANADIAN PORCELAIN COMPANY.—The Canadian Porcelain Company, Ltd., has been incorporated with a capital stock of $300,000 to manufacture vitrified white porcelain for electrical and other purposes. The company has purchased a 20-acre site in Hamilton, Ontario, and will put up a plant. The buildings will be of steel and brick and will be ready for operation next spring. Messrs. John Alden, Charles Palmer, of Rochester, and Fred D. Palmer, of Galt, Ontario, are the principal directors.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 19, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,044,480. SANITARY SHIELD FOR TELEPHONE TRANSMITTERS; R. W. Bogart, Jr., New York, N. Y. App. filed Nov. 9, 1911. A roll of severable paper.

1,044,507. ELECTRIC-SWITCH MECHANISM; E. Edwards and G. W. Briggs, Rigby, Idaho. App. filed Nov. 20, 1911. Electric-sign-flashing switch.

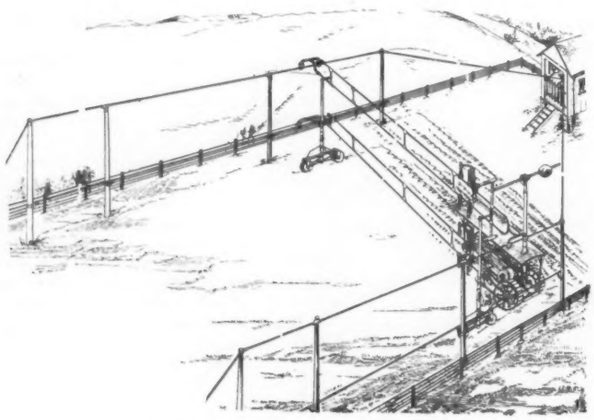
1,044,521. CONDUIT FITTING; M. Havens, Jr., Albany, N. Y. App. filed Feb. 18, 1910. Two-piece pot-head.

1,044,538. SELECTIVE APPARATUS FOR PARTY TELEPHONES; D. W. Kneisly, Dayton, Ohio. App. filed Feb. 8, 1908. Lock-out and automatic restorer. (Improvement on patent No. 860,920.)

1,044,549. ELECTRIC BATTERY; W. H. Lowe, Brondesbury, England. App. filed March 23, 1912. Mechanical support of the electrodes.

1,044,562. ELECTRIC RESISTANCE; C. A. Mudge, New York, N. Y. App. filed July 16, 1906. Grid resistance; alloy of high carbon, iron aluminum and silicon.

1,044,595. CONTACT SHOE; F. A. Stuhlfeier, Chicago, Ill. App. filed May 19, 1909. Pressure device and teeth for cutting sleet, etc.



1,044,751.—Electrical Agricultural System.

1,044,609. MEANS FOR CONTROLLING ELECTRIC MOTORS; J. T. Watson, Copperhill, Tenn. App. filed Oct. 19, 1911. Belt-conveyor system.

1,044,640. DYNAMO-ELECTRIC MACHINE; V. A. Fynn, London, England. App. filed May 23, 1911. Motor or converter; particularly for storage-battery vehicle.

1,044,641. ROTARY CONVERTER; V. A. Fynn, London, England. App. filed May 23, 1911. Automatic starting from the alternating-current side.

1,044,700. OZONIZER; R. D. Small & O. Linder, Chicago, Ill. App. filed April 4, 1911. For ventilating systems, refrigerators, etc.

1,044,717. BINDING POST; P. E. Wiberg, Glen Ridge, N. J. App. filed Feb. 5, 1912. A clamp adapted for wires of different diameters.

1,044,747. TELEPHONE SYSTEM; H. P. Clausen, Chicago, Ill. App. filed Feb. 3, 1902. Metallic-circuit central-energy type; line and supervisory signal operation.

1,044,748. TELEPHONE SYSTEM; H. P. Clausen, Chicago, Ill. App. filed April 21, 1902. Common central-battery system; line-signal operation. (Forty-four claims.)

1,044,751. ELECTRICAL AGRICULTURAL SYSTEM; C. S. Doney, Columbia Falls, Mont. App. filed Feb. 27, 1912. Trolley system for driving plows, etc.

1,044,798. WIRELESS-TELEPHONE TRANSMITTER; J. P. McCarty, K. Douglas and F. P. Herrguth, Oakland and San Francisco, Cal. App. filed May 17, 1909. Wheatstone bridge and high-tension transformer.

1,044,819. ELECTRIC RAILWAY; W. B. Purvis and A. DeW. Gritman, Sharon Hill and Philadelphia, Pa. App. filed Dec. 1, 1909. Sectional conduit third-rail.

1,044,825. DOUBLE-ENDED ELECTRIC LAMP; B. Settecase, Louisville, Ky. App. filed March 6, 1911. Terminal rings around the middle; for signs.

1,044,827. MEANS TO CONTROL MAGNETIC CIRCULATION IN ELECTRIC-CURRENT-PRODUCING DEVICES; E. F. Smith, Cincinnati, Ohio. App. filed Oct. 1, 1910. For electric tools such as drills and grinders.

1,044,831. STORAGE-BATTERY GRID; F. F. Wackwitz, Cleveland, Ohio. App. filed July 8, 1912. Ribs radiate from the terminal.

1,044,865. TELEPHONE-EXCHANGE SYSTEM; W. W. Dean, Elyria, Ohio. App. filed Aug. 8, 1904. Metallic-circuit common-battery type with a pair of relays for each line.

1,044,885. CONNECTOR; W. P. Hammond, Passaic, N. J. App. filed Nov. 4, 1911. Annular spring jaw clip for binding-post connections, etc.

1,044,901. STEERING INDICATOR; F. B. Mills, Chicago, Ill. App. filed Feb. 7, 1912. Rear danger signal for automobile.

1,044,922. PRIMARY BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed March 17, 1911. Centrally suspended zinc electrode. (Improvement on patents Nos. 687,647 and 687,648.)

1,044,923. CORD TERMINAL; C. B. Schoenmehl, Waterbury, Conn. App. filed June 14, 1912. Socket and perforated plate for connection to binding posts, etc.

1,044,927. ELECTRICAL RESISTANCE FURNACE; O. Serpek, Paris, France. App. filed June 21, 1910. Rotary furnace with a plurality of resistance elements embedded in the lining; particularly for manufacturing aluminum nitride.

1,044,928. REVOLVING ELECTRICAL FURNACE WITH RESISTANCE ARRANGED DIAMETRICALLY; O. Serpek, Paris, France. App. filed April 11, 1911. A plurality of pairs of electrodes; for aluminum nitride, etc.

1,044,944. PULLEY BRAKE FOR MOTOR-CONTROLLED APPARATUS; M. Taigman, New York, N. Y. App. filed April 3, 1912. For motor-driven sewing machines, etc.

1,044,950. APPARATUS FOR ELECTRIC LIGHTING; W. D. Uptegraff, Pittsburgh, Pa. App. filed May 26, 1909. Two or more glowers having different characteristics.

1,044,957. ELECTRIC FURNACE FOR PRODUCING OXIDES OR PHOSPHORUS FROM NATURAL PHOSPHATES; F. S. Washburn, Nashville, Tenn. App. filed June 17, 1912. Vertical charge feed and inclined electrodes above the hearth.

1,044,978. TROLLEY; A. F. Bevard, Carnegie, Pa. App. filed July 19, 1912. A yieldingly mounted harp.

1,044,981. COMBINED TELEGRAPH AND TELEPHONE SYSTEM; C. L. Bopp, Hawkeye, Ia. App. filed Nov. 27, 1909. Balanced system.

1,044,984. ELECTROMAGNETIC REVERSING GEAR; R. Brukwicki, Rakowo, Germany. App. filed March 28, 1912. Electrical and mechanical connection between the armatures of two synchronous machines.

1,045,034. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Aug. 10, 1911. Pilot clearing-out indicator controlled by line-signal devices.

1,045,043. BLOCK-SIGNAL SYSTEM; W. A. Lacke, Chicago, Ill. App. filed Aug. 7, 1909. Multiple-position semaphore automatically controlled by the movement of the rolling stock.

1,045,051. REFILLABLE CARTRIDGE FUSE; E. B. Mallory, Wilkinsburg, Pa. App. filed Oct. 10, 1911. Removable end caps, washers and terminals.